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LATHAM & WATKINS LLP

May 25, 2012

VIA U.S. MAIL

Jack Miller
Director
County of San Diego Dep't of Env'tl. Health
P.O. Box 129261
San Diego, CA 92112-9261

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File No. 051247-0000

Re: Compliance with CEQA Notice Requirements for Notice of Intent to Adopt a Negative Declaration Regarding the Eye Gnat Ordinance and Program

Dear Director Miller:

I am writing on behalf of my client, Be Wise Ranch, regarding the recent Notice of Intent to Adopt a Negative Declaration (the "Notice") regarding the County of San Diego's proposed Eye Gnat Ordinance and Program ("Proposed Ordinance"). As I detail below, the Notice is deficient in a number of respects:

- The Notice should have been sent to the State Clearinghouse in accordance with section 15206 of the Public Resources Code.
- The 20-day review period stated in the Notice is incorrect. The review period should be 30 days, in accordance with section 21091 of the Public Resources Code.

We believe that at a minimum, the State Department of Fish & Game, San Diego Regional Water Quality Control Board, and possibly the U.S. Fish & Wildlife Service should have been officially noticed of this action. The necessary involvement of these agencies triggers the requirements outlined above.

Accordingly, we request that the County reissue the Notice in compliance with the California Environmental Quality Act, including but not limited to formal notice to the agencies listed above, distribution to the State Clearinghouse, and a correction to the length of the review period.

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I. THE PROPOSED ORDINANCE IS OF STATEWIDE, REGIONAL, OR AREAWIDE SIGNIFICANCE AND MUST BE SUBMITTED TO THE STATE CLEARINGHOUSE FOR REVIEW AND COMMENT BY THE APPROPRIATE STATE AND LOCAL AGENCIES.

Section 15206 of the Public Resources Code states that a negative declaration for a project of "statewide, regional, or areawide significance . . . shall be submitted to the State Clearinghouse and . . . the appropriate metropolitan area council of governments for review and comment." Express examples that fit the Proposed Ordinance include:

- "A project [with] the potential for causing significant effects on the environment extending beyond the city or county in which the project would be located."¹
- "A project which would substantially affect sensitive wildlife habitats including but not limited to riparian lands, wetlands, bays, estuaries, marshes, and habitats for endangered, rare and threatened species"²
- "A project which would interfere with attainment of regional water quality standards as stated in the approved areawide waste treatment management plan."³

Be Wise Ranch is directly adjacent to San Dieguito River, Lake Hodges, and associated wetlands.⁴ Contrary to the Initial Study's conclusion that the Proposed Ordinance "will not impact through, discharging into, . . . or hydrologically interrupting, any federally protected wetlands," the mandatory application of pesticides as contemplated by the Proposed Ordinance will result in the deposit of those pesticides into the San Dieguito River, Lake Hodges, and wetlands via irrigation and stormwater runoff.⁵ In addition, Be Wise Ranch is within a Multiple Habitat Species Conservation area where the federally protected arroyo toad is known to reside and travel.⁶ These conditions trigger required notice to appropriate state agencies, including but not limited to the State Department of Fish & Game, the San Diego Regional Water Quality Control Board, and potentially the U.S. Fish & Wildlife Service.

¹ Pub. Res. Code § 15206(b)(2).

² Id. § 15206(b)(5).

³ Id. § 15206(b)(6).

⁴ Exhibit A, Be Wise Ranch Site Summary.

⁵ See County of San Diego, CEQA INITIAL STUDY – ENVIRONMENTAL CHECKLIST FORM, at p. 21 (May 24, 2012).

⁶ U.S. Geological Survey, DISTRIBUTION AND STATUS OF THE ARROYO TOAD (*BUFO CALIFORNICUS*) AND WESTERN POND TURTLE (*EMYS MARMORATA*) IN THE SAN DIEGO MSCP AND SURROUNDING AREAS, at pp. 17-18 (Oct. 11, 2005) (prepared for California Dep't of Fish & Game and County of San Diego).

LAT: AM & WATKINS LLP

- A. The Proposed Ordinance has the “potential for causing significant effects on the environment extending beyond the city or county in which the project would be located.”

The water quality of the San Dieguito River is regulated by a National Pollutant Discharge Elimination System (“NPDES”) Municipal Stormwater Permit.⁷ This permit requires the implementation of a Watershed Runoff Management Program, which is managed jointly by the Cities of Del Mar, Escondido, Poway, San Diego, and Solana Beach, and the County of San Diego.⁸ Because of the certainty of increased pesticide runoff into the San Dieguito River, the Proposed Ordinance has the “potential for causing significant effects on the environment extending beyond” this area of Escondido and possibly to the Pacific Ocean. Furthermore, the actions contemplated by the Proposed Ordinance affect compliance with the NPDES permit, which implicates the five city co-permittees in addition to the County of San Diego, as well as federal protections for endangered species such as the arroyo toad.

- B. The Proposed Ordinance also has the potential to “substantially affect sensitive wildlife habitats including but not limited to riparian lands, wetlands, bays, estuaries, marshes, and habitats for endangered, rare and threatened species.”

As noted above, Be Wise Ranch is adjacent to the San Dieguito River, Lake Hodges, and associated wetlands. In addition, Be Wise Ranch is in an area where the federally protected arroyo toad is known to reside and travel. The requirement to give notice to appropriate state agencies does not depend on the County’s determination of significance of impact. In other words, although the Initial Study purports to find a less than significant impact to wetlands and biological resources, this does not negate the requirement to give notice to the appropriate state agencies. In fact, the Initial Study’s acknowledgement of some impact indicates that the State Department of Fish & Game, and possibly the U.S. Fish & Wildlife Service, should be officially notified of the proposed action to solicit their review and comment.

- C. The Proposed Ordinance “would interfere with attainment of regional water quality standards as stated in the approved areawide waste treatment management plan.”

As noted above, the water quality of the San Dieguito River is regulated by a Clean Water Act NPDES permit. In addition, the San Dieguito River is a TMDL-impaired waterway.⁹ The application of pesticides will result in increased pollution in irrigation and stormwater runoff, which may impair the recovery of the San Dieguito River. Although the Initial Study purports to find a less than significant impact to hydrology and attainment of water quality

⁷ SAN DIEGUITO WATERSHED URBAN RUNOFF MANAGEMENT PROGRAM, at Executive Summary p. 1 (Mar. 2008).

⁸ Ibid.

⁹ San Diego Regional Water Quality Control Board, CLEAN WATER ACT SECTIONS 305(B) AND 303(D) INTEGRATED REPORT FOR THE SAN DIEGO REGION STAFF REPORT, Appendix B at p. 85 (Dec. 2009). See also Exhibit A, Be Wise Ranch Site Summary; id. at Introduction p. 8.

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continued

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objectives, this does not negate the requirement to notify the Regional Water Quality Control Board to solicit its review and comment. Similar to the acknowledged biological impact, the fact that the Initial Study acknowledged some impact to the attainment of water quality objectives indicates that the San Diego Water Quality Control Board should be officially notified of the proposed action to solicit its review and comment.

Without proper notice to the State Clearinghouse and, at a minimum, the State Department of Fish & Game and the San Diego Regional Water Quality Control Board, the Notice is defective.

II. BECAUSE THE NOTICE MUST BE SENT TO THE STATE CLEARINGHOUSE, THE PERIOD FOR PUBLIC REVIEW AND COMMENT IS, AT A MINIMUM, 30 DAYS.

The Notice is also defective in purporting to limit the period for public review to 20 days. Because the Notice must be submitted to the State Clearinghouse, the period for public review must be at least 30 days.¹⁰ We request that the County correctly specify the duration of the public review period for this proposed negative declaration. The review period should be, at a minimum, 30 days.

* * *

Please do not hesitate to contact me at (619) 238-2827 or at christopher.garrett@lw.com if you have any questions or concerns.

Best regards,



Christopher W. Garrett
of LATHAM & WATKINS LLP

Enclosure

cc: Rodney Lorang
Linda Hollingsworth
David Gibson
Ed Pert
Cecelia Gallardo
Carl DeMaio, c/o John Ly
David Martens
Nicole McGinnis
Brian Schoenfisch
Jeanne Krosch
Bill Brammer

¹⁰ Pub. Res. Code § 21091(b).

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continued

EXHIBIT A
BE WISE RANCH SITE SUMMARY

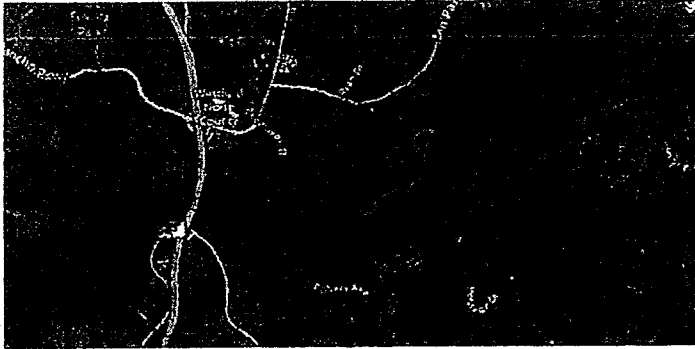




NEPAssist Report

BWR1

Project Location Map



National Report

Project Area	0.23 sq mi
Within 75 miles of an Ozone 8-hr Non-Attainment Area?	yes
Within 25 miles of a PM2.5 Non-Attainment Area?	no
Within 25 miles of a Lead Non-Attainment Area?	no
Within 25 miles of a Federal Land?	no
Within 25 miles of an Impaired stream?	yes
Within 25 miles of an impaired waterbody?	no
Within 25 miles of a waterbody?	yes
Within 25 miles of a stream?	yes
Within 25 miles of an NWI wetland?	yes
Within 25 miles of a Brownfields site?	no
Within 25 miles of a Superfund site?	no
Within 25 miles of a Toxic Release Inventory (TRI) site?	no
Within 25 miles of a water discharger (NPDES)?	no
Within 25 miles of a hazardous waste (RCRA) facility?	no
Within 25 miles of an air emission facility?	no
Within 25 miles of a school?	no
Within 25 miles of an airport?	no
Within 25 miles of a hospital?	no
Within 25 miles of a designated sole source aquifer?	no

California Report

Within 0.25 miles of a Wild and Scenic River?	no
Within 0.25 miles of a roadless area?	no

BWR2

Project Area	0.05 sq mi
<u>Within 25 miles of an Ozone 8-hr Non-Attainment Area?</u>	YES
<u>Within 25 miles of a PM2.5 Non-Attainment Area?</u>	NO
<u>Within 25 miles of a Lead Non-Attainment Area?</u>	NO
<u>Within 25 miles of a Federal Land?</u>	NO
<u>Within 25 miles of an Impaired stream?</u>	NO
<u>Within 25 miles of an impaired waterbody?</u>	NO
<u>Within 25 miles of a waterbody?</u>	NO
<u>Within 25 miles of a stream?</u>	YES
<u>Within 25 miles of an NWI wetland?</u>	YES
<u>Within 25 miles of a Brownfields site?</u>	NO
<u>Within 25 miles of a Superfund site?</u>	NO
<u>Within 25 miles of a Toxic Release Inventory (TRI) site?</u>	NO
<u>Within 25 miles of a water discharger (NPDES)?</u>	NO
<u>Within 25 miles of a hazardous waste (RCRA) facility?</u>	NO
<u>Within 25 miles of an air emission facility?</u>	NO
<u>Within 25 miles of a school?</u>	NO
<u>Within 25 miles of an airport?</u>	NO
<u>Within 25 miles of a hospital?</u>	NO
<u>Within 25 miles of a designated sole source aquifer?</u>	NO

Within 0.25 miles of a Wild and Scenic River? NO

Within 0.25 miles of a roadless area? NO



Be Wise Ranch, Inc.
20505 San Pasqual Road
Escondido, CA 92025
PH: (760) 746-6006

June 20, 2012

A.2

RCUD JUN 20 12

VIA E-MAIL & FEDEX

Jack Miller, Director
Department of Environmental Health
Attn: Eye Gnat Ordinance and Program
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Comments on Negative Declaration and Initial Study for Eye Gnat Ordinance and Program

Dear Director Miller:

Be Wise Ranch is submitting these comments to express concerns regarding the County of San Diego's Eye Gnat Ordinance and Program. Be Wise Ranch asks the County to review the many potentially significant environmental impacts of the Proposed Ordinance in an Environmental Impact Report. But at a minimum, the County should re-notice the Negative Declaration and Initial Study to the appropriate state and local agencies and to provide the appropriate time for public review—a full 30 days.

Be Wise Ranch is one of San Diego's leading providers of locally grown, certified organic produce since 1977. We offer a broad range of certified organic fruit and vegetables, which we grow year round in an environmentally sustainable way for healthy, productive living. We provide a produce-delivery service program for the local San Diego community, and we are a partner to a number of local San Diego civic and educational organizations, such as the Girl Scouts of America, Cardiff School District, the UCSD Triathlon Team, and the North County Food Bank.

The history of Be Wise Ranch demonstrates that agriculture can be environmentally sustainable and compatible with a variety of uses in the same area—including public recreation and the protection of water quality in the nearby San Dieguito River and Lake Hodges. Our farming practices are not only sustainable, but also safe and good for the land. We do not use synthetic pesticides, herbicides, or fertilizers to grow our produce, but we are nonetheless able to grow healthy produce year after year and preserve the quality of the land for future generations.

Be Wise Ranch has been cooperating with the County and the local community as a good neighbor. Our voluntary control plan for eye gnats, based on the available data for this year, has resulted in a 98% reduction in eye gnats since 2010. Our Voluntary Prevention & Control Plan and our latest status report regarding our efforts are enclosed in Attachment A. We have installed eye gnat traps on our farm and have helped our neighbors do the same, and we have installed other measures, like 13,000-feet of a physical barrier between our farm and the community.

Among other things, we are concerned that some of the actions that may be required by the Proposed Ordinance would cause Be Wise Ranch to lose our organic certification or would otherwise be so cost prohibitive that it would mean the end of organic farming in this area, which would cause a variety of undesirable environmental changes in the area. In addition, we are concerned that the County is rushing into this ordinance without any thoughtful environmental review and without seeing whether our voluntary efforts will succeed. A major organic farm in Jacumba closed down recently, so if our voluntary



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efforts are successful, we wonder why the ordinance would be necessary, particularly given the potentially significant environmental impacts it might cause.

Our comments are supported by various studies and sources, which we will provide electronically. Thank you for considering our comments and supporting materials. If you have any questions, please contact me at (760) 746-6006 or bb.bewise@yahoo.com.

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continued

Sincerely,

Bill Brammer
Founder and Owner
Be Wise Ranch

RCUD JUN 20 12

COMMENTS ON
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
EYE GNAT ORDINANCE AND PROGRAM
AND NEGATIVE DECLARATION

Submitted by

Be Wise Ranch
20505 San Pasqual Road
Escondido, CA 92025

Counsel

LATHAM & WATKINS LLP
600 W. Broadway, Suite 1800
San Diego, CA 92101
Tel: (619) 236-1234
Fax: (619) 696-7419
Christopher W. Garrett

Date

June 20, 2012

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I. INTRODUCTION

Be Wise Ranch submits these comments in response to the County of San Diego's (the "County") Notice of Intent to Adopt a Negative Declaration (the "Notice" or "Negative Declaration") regarding the County of San Diego's proposed Eye Gnat Ordinance and Program ("Proposed Ordinance").

The Negative Declaration for the Proposed Ordinance is not supported by the evidence or by common sense, and it is procedurally improper. As described in more detail below, the environmental effects of the Proposed Ordinance must be evaluated in an Environmental Impact Report ("EIR"). There are a myriad of potentially significant environmental impacts that may occur because of the Proposed Ordinance, which may require commercial farms to spray chemical pesticides on their crops. This is particularly the case with Be Wise Ranch, which sits on prime farmland that is adjacent to public recreational areas, substantial drinking water supplies, and other water bodies that are currently regulated by the federal Clean Water Act.

The Notice, therefore, should have been sent to the appropriate state, local, and possibly federal agencies for review and comment, and the County's failure to notice the appropriate agencies and to provide the appropriate public review period renders the Negative Declaration procedurally improper.

The County should determine that an EIR is required and draft an EIR to review the potentially significant impacts to the environment detailed below. At a minimum, the County must re-notice their Negative Declaration to the appropriate agencies for the appropriate length of time—a minimum of a full 30 days.¹

II. THE PROPOSED ORDINANCE IS OF STATEWIDE, REGIONAL, OR AREAWIDE SIGNIFICANCE AND MUST BE SUBMITTED TO THE STATE CLEARINGHOUSE FOR REVIEW AND COMMENT BY THE APPROPRIATE STATE AND LOCAL AGENCIES

Section 15206 of the Public Resources Code states that a negative declaration for a project of "statewide, regional, or areawide significance . . . shall be submitted to the State Clearinghouse and . . . the appropriate metropolitan area council of governments for review and comment." Express examples that fit the Proposed Ordinance include:

- "A project [with] the potential for causing significant effects on the environment extending beyond the city or county in which the project would be located."²
- "A project which would substantially affect sensitive wildlife habitats including but not limited to riparian lands, wetlands, bays, estuaries, marshes, and habitats for endangered, rare and threatened species"³

¹ Latinos Unidos de Napa v. City of Napa (2011) 196 Cal.App.4th 1154, 1167.

² Pub. Res. Code § 15206(b)(2).

- “A project which would interfere with attainment of regional water quality standards as stated in the approved areawide waste treatment management plan.”⁴

Be Wise Ranch is directly adjacent to San Dieguito River, Lake Hodges, and associated wetlands.⁵ Contrary to the Initial Study’s conclusion that the Proposed Ordinance “will not impact through, discharging into, . . . or hydrologically interrupting, any federally protected wetlands,” the mandatory application of pesticides as contemplated by the Proposed Ordinance will result in the deposit of those pesticides into the San Dieguito River, Lake Hodges, and wetlands via irrigation and stormwater run-off.⁶ In addition, Be Wise Ranch is within a Multiple Habitat Planning Area (“MHPA”) area where the federally protected arroyo toad is known to reside and travel.⁷ These conditions trigger required notice to appropriate state agencies, including but not limited to the State Department of Fish & Game, the San Diego Regional Water Quality Control Board, and potentially the U.S. Fish & Wildlife Service.

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continued

- A. The Proposed Ordinance has the “potential for causing significant effects on the environment extending beyond the city or county in which the project would be located”

The water quality of the San Dieguito River is regulated by a National Pollutant Discharge Elimination System (“NPDES”) Municipal Stormwater Permit.⁸ This permit requires the implementation of a Watershed Run-off Management Program, which is managed jointly by the Cities of Del Mar, Escondido, Poway, San Diego, and Solana Beach, and the County of San Diego.⁹ Because of the certainty of increased pesticide run-off into the San Dieguito River, the Proposed Ordinance has the “potential for causing significant effects on the environment extending beyond” this area of Escondido and possibly to the Pacific Ocean. Furthermore, the actions contemplated by the Proposed Ordinance affect compliance with the NPDES permit,

³ Id. § 15206(b)(5).

⁴ Id. § 15206(b)(6).

⁵ Attachment A, Be Wise Ranch Site Summary.

⁶ See Attachment B, COUNTY OF SAN DIEGO, CEQA INITIAL STUDY – ENVIRONMENTAL CHECKLIST FORM 21 (May 24, 2012), *available at* http://www.sdcounty.ca.gov/deh/pests/pdf/Eye_Gnats/Initial_Study_DEH_EyeGnatProgram_-_FINAL_PUBLIC_REVIEW_-_with_signature_-_May_24_2012.pdf [hereinafter INITIAL STUDY].

⁷ Attachment C, U.S. GEOLOGICAL SURVEY, DISTRIBUTION AND STATUS OF THE ARROYO TOAD (BUFO CALIFORNICUS) AND WESTERN POND TURTLE (EMYS MARMORATA) IN THE SAN DIEGO MSCP AND SURROUNDING AREAS 17–18 (Oct. 11, 2005) [prepared for California Dep’t of Fish & Game and County of San Diego], *available at* http://www.sdcounty.ca.gov/dplu/mscp/docs/Toad_Turtle_Distribution_and_Status.pdf.

⁸ Attachment D, SAN DIEGUITO WATERSHED URBAN RUNOFF MANAGEMENT PROGRAM, at Executive Summary p. 1 (Mar. 2008), *available at* http://www.projectcleanwater.org/pdf/wurmp/sdg_wurmp_2008.pdf.

⁹ Ibid.

which implicates the five city co-permittees in addition to the County, as well as federal protections for endangered species such as the arroyo toad.

5
continued

- B. The Proposed Ordinance also has the potential to “substantially affect sensitive wildlife habitats including but not limited to riparian lands, wetlands, bays, estuaries, marshes, and habitats for endangered, rare and threatened species”

As noted above, Be Wise Ranch is adjacent to the San Dieguito River, Lake Hodges, and associated wetlands. In addition, Be Wise Ranch is in an area where the federally protected arroyo toad is known to reside and travel. The requirement to give notice to appropriate state agencies does not depend on the County’s determination of significance of impact. In other words, although the Initial Study purports to find a less than significant impact to wetlands and biological resources, this does not negate the requirement to give notice to the appropriate state agencies. In fact, the Initial Study’s acknowledgement of some impact indicates that the State Department of Fish & Game, and possibly the U.S. Fish & Wildlife Service, should be officially notified of the proposed action to solicit their review and comment.

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- C. The Proposed Ordinance “would interfere with attainment of regional water quality standards as stated in the approved areawide waste treatment management plan”

As noted above, the water quality of the San Dieguito River is regulated by a Clean Water Act NPDES permit. In addition, the San Dieguito River is a TMDL-impaired waterway.¹⁰ The application of pesticides will result in increased pollution in irrigation and stormwater run-off, which may impair the recovery of the San Dieguito River. Although the Initial Study purports to find a less than significant impact to hydrology and attainment of water quality objectives, this does not negate the requirement to notify the Regional Water Quality Control Board to solicit its review and comment. Similar to the acknowledged biological impact, the fact that the Initial Study acknowledged some impact to the attainment of water quality objectives indicates that the San Diego Regional Water Quality Control Board should be officially notified of the proposed action to solicit its review and comment.

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Without proper notice to the State Clearinghouse and, at a minimum, the State Department of Fish & Game and the San Diego Regional Water Quality Control Board, the Notice is defective.

III. BECAUSE THE NOTICE MUST BE SENT TO THE STATE CLEARINGHOUSE, THE PERIOD FOR PUBLIC REVIEW AND COMMENT IS, AT A MINIMUM, 30 DAYS

¹⁰ Attachment E, SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD, CLEAN WATER ACT SECTIONS 305(B) AND 303(D) INTEGRATED REPORT FOR THE SAN DIEGO REGION STAFF REPORT, APPENDIX B 85 (Dec. 2009), *available at* http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/303d_list/docs/updates_020910/App_B_All_Decisions.pdf [hereafter 303(D) LIST]. See also Be Wise Ranch Site Summary, *supra* note 5; *id.* at Introduction p. 8.

The Notice is also defective in purporting to limit the period for public review to 20 days. Because the Notice must be submitted to the State Clearinghouse, the period for public review must be at least 30 days.¹¹ We request that the County correctly specify the duration of the public review period for this proposed negative declaration. The review period should be, at a minimum, 30 days.

7.
continued

IV. OTHER STAKEHOLDERS HAVE NOT RECEIVED NOTICE OF THE NEGATIVE DECLARATION

The California Environmental Quality Act ("CEQA") requires broad notification of public and private entities that will be impacted by a proposed Project. The County has not notified property owners and stakeholders in the San Pasqual Valley who may have concerns with the potential for pesticide spraying in the San Pasqual Valley.

At a minimum, we believe the following stakeholders should be notified:

1. San Pasqual Community Planning Group
2. Rancho Bernardo Planning Group
3. San Dieguito River Park Joint Powers Authority ("JPA")
4. San Dieguito River Conservancy
5. The San Diego Wild Animal Park
6. Private property owners in the San Pasqual Valley

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V. BIOLOGICAL IMPACTS

- A. Significant impacts to the federally endangered arroyo toad may occur

The arroyo toad was first listed as endangered under the federal Endangered Species Act by the U.S. Fish & Wildlife Service in 1994.¹² The arroyo toad is also considered a Species of Special Concern by the California Department of Fish & Game and a Protected Amphibian under the State Fish & Game Code.¹³

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¹¹ Pub. Res. Code § 21091(b).

¹² Attachment F, Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for the Arroyo Toad (Feb. 7, 2001) 66 Fed. Reg. 9414, 9416, *available at* <http://www.gpo.gov/fdsys/pkg/FR-2001-02-07/pdf/01-2253.pdf> [hereinafter *Arroyo Toad Critical Habitat*].

¹³ Attachment G, STATE OF CALIFORNIA DEP'T OF FISH & GAME, CALIFORNIA NATURAL DIVERSITY DATABASE SPECIAL ANIMALS 35 (Jan. 2011), *available at* <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/spanimals.pdf>.

Be Wise Ranch is located in an area that is known as habitat for the endangered arroyo toad. The Be Wise Farm lease ("Lease") with the City of San Diego (the "City") specifically acknowledges the potential for impacts to the arroyo toad. The Lease requires that the farm "not use chemical fertilizers, pesticides or herbicides," because of potential harm to the endangered arroyo toad which lives and breeds in the area.¹⁴ The lease states, "LESSEE has been advised and acknowledges that the boundaries of the leased premises are located in the CITY, Multiple Habitat Species Conservation Program . . . Lake Hodges/San Pasqual Valley Cornerstone Lands . . . LESSEE will provide fencing that allows movement of the arroyo toads and keep agricultural operations out of the [Multiple Habitat Planning Area or] MHPA, not use chemical fertilizers, pesticides or herbicides."¹⁵

Indeed, it is clear that there is a very high potential for a significant impact to the arroyo toad from the implementation of the Proposed Ordinance, which requires the spraying of chemical pesticides. The U.S. Fish & Wildlife Service warned, "[h]uman activities that may cause adverse impacts to arroyo toads include . . . the use of pesticides and herbicides within or adjacent to arroyo toad habitat."¹⁶ Because significant impacts may occur, an EIR is required to analyze the impacts and provide mitigation.

The U.S. Environmental Protection Agency ("U.S. EPA") has warned expressly that the pesticides Malathion, Diflubenzuron, and Cyfluthrin may have adverse impacts on aquatic species.¹⁷ Within the San Pasqual Valley area, there is a use limitation for these pesticides that states, "Do not use in currently occupied habitat."¹⁸ The City has indicated in the Lease that arroyo toads may be present on the farm or in the area. Therefore, an investigation to determine if arroyo toads are present would be required prior to spraying, and the potential for a significant impact to this federally endangered species is likely. Therefore, an EIR must be completed to determine if a significant impact will occur and what mitigation will be required.

- B. Malathion spraying could affect bee colonies and other beneficial insects used for agricultural operations in the San Pasqual Valley, and therefore a significant impact may occur

Colony Collapse Disorder has become a serious concern for beekeepers and farms alike. Colony collapse has led to the mass mortality of honeybees around the United States, resulting in shortages of bee colonies to pollinate important crops. Recent studies have implicated pesticides as being responsible for Colony Collapse Disorder. The U.S. EPA has warned of the toxic effects of Malathion, stating that Malathion "may be highly toxic to bees[] and has been shown to be

¹⁴ Attachment X, Lease, § 9.4

¹⁵ *Ibid.* (emphasis added).

¹⁶ *Arroyo Toad Critical Habitat*, *supra* note 12, at 9415.

¹⁷ See Attachment H, U.S. EPA, PROTECTING ENDANGERED SPECIES INTERIM MEASURES FOR USE OF INSECTICIDES IN SAN DIEGO COUNTY 9 (Nov. 1998), *available at* <http://www.cdpr.ca.gov/docs/endspec/espdfs/37in1198.pdf> [hereafter PROTECTING ENDANGERED SPECIES].

¹⁸ *Id.* at pp. 9-12.

lethal to many species of beneficial insects when used near or over nonagricultural areas containing beneficial insect populations. However, the Agency does not yet have a method to estimate risk to bees and other non-target insect organisms. Therefore, the Agency cannot preclude possible adverse effects to beneficial and listed insect species.”¹⁹ The Negative Declaration has not analyzed whether the spraying of Malathion in an agricultural preserve area that is dependent on beneficial insects for pollination and pest eradication, could be detrimental to those insects and the agricultural operations that depend on them. There appears to be a potential impact, and mitigation may be required to prevent exposure of beneficial insects (like bee colonies) to Malathion spraying for eye gnat abatement.

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- C. Biologically sensitive habitats in the area will be impacted by the spraying of pesticides

Be Wise Ranch is located in the City Multiple Habitat Planning Area (“MHPA”). The MSCP subarea plan notes that Be Wise Ranch is located amongst important habitats in the MHPA that support sensitive plant and animal species:

The Hodges Reservoir/San Pasqual Valley core area represents one of the largest continuous blocks of habitat in the MSCP study area and serves as a major east-west corridor. This area includes core gnatcatcher and cactus wren populations, one of the two “centers of distribution” for Encinitas baccharis in the MSCP study area, large expanses of grassland that provide valuable raptor foraging habitat and valuable wetland habitat in San Pasqual Valley which supports several MSCP target species dependent on riparian habitats. The western portion of the valley, east of I-15 and above the drawdown area of the lake, is currently an intensively farmed agricultural preserve which has been cultivated since before this century.

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The most important areas for conservation are those natural areas around Hodges Reservoir, the riparian habitat along the San Dieguito River and its tributaries through San Pasqual Valley, and the naturally vegetated slopes above the river valley. The majority of the riparian habitats in the river valley provide excellent opportunities for restoration and enhancement of the wildlife corridor through the valley. Conserved lands in the Hodges Reservoir/San Pasqual Valley area will be the cornerstone for a

¹⁹ Attachment I, U.S. EPA, *Reregistration Eligibility Decision (RED) for Malathion* (July 2006) No. 0248, at p. 58, available at http://www.epa.gov/oppsrrd1/REDs/malathion_red.pdf.

natural east/west open space corridor within the San Dieguito River Valley and San Pasqual Valley.²⁰

The Negative Declaration fails to identify or even analyze the potential impacts to these sensitive habitats. As noted in II.A above, Be Wise Ranch has been precluded from using chemical pesticides, specifically due to the property's proximity to sensitive habitat. A County order to use pesticides to abate eye gnats would significantly change the existing environment of the area and the agricultural operations of the farm, which could have significant impacts on the adjacent MHPA area. In addition, the U.S. EPA has warned that the pesticide Diflubenzuron has the potential to adversely affect avian species such as the Least Bell's Vireo.²¹ Within the San Pasqual Valley area, there is a use limitation for these pesticides that states, "Do not use in currently occupied habitat."²² A full biological analysis is required as part of an EIR to determine the location of Least Bell's Vireo in the area where Diflubenzuron would be sprayed and to determine the extent of impacts, and necessary mitigation.

VI. AGRICULTURAL RESOURCES

A. Conversion of Prime Farmland and Farmland of Statewide Importance

The Proposed Ordinance has the potential to convert Prime Farmland and Farmland of Statewide Importance to non-agricultural purposes. The Be Wise Ranch area is designated by the California Department of Conservation as including Prime Farmland and Farmland of Statewide Importance.²³

Prime Farmland is "Farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date."²⁴

Farmland of Statewide Importance is defined as "Farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must

²⁰ Attachment J, CITY OF SAN DIEGO, MSCP SUBAREA PLAN 29 (Mar. 1997), available at <http://www.sandiego.gov/planning/mscp/pdf/subareafullversion.pdf> [hereafter CITY MSCP SUBAREA PLAN].

²¹ See PROTECTING ENDANGERED SPECIES, *supra* note 17, at p. 9.

²² See *id.* at pp. 9–13.

²³ Attachment K, STATE OF CALIFORNIA DEP'T OF CONSERVATION, SAN DIEGO COUNTY IMPORTANT FARMLAND 2008 (2008), available at ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2008/sdg08_west.pdf.

²⁴ Attachment L, *Important Farmland Map Categories*, STATE OF CALIFORNIA DEP'T OF CONSERVATION, http://www.conservation.ca.gov/dlrp/fmmp/mccu/Pages/map_categories.aspx (last visited June 18, 2012).

have been used for irrigated agricultural production at some time during the four years prior to the mapping date.”²⁵

1. Conversion from Organic Agriculture

The Proposed Ordinance makes it clear that the County can and will require eye gnat abatement strategies that will cause Be Wise Ranch organic farm to lose its organic certification, and thereby convert Prime Farmland and Farmland of Statewide Importance to open space. Although the Proposed Ordinance states that tactics that would eliminate organic agriculture on particular site would be used “only as a last resort,” the Proposed Ordinance is very clear that the County has determined that, if needed, its “policy” is to use its regulatory authority to “cause the loss of organic farming certifications, or that would restrict crops grown on a farm.”²⁶

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CEQA requires that the all of the potential impacts of the ordinance must be evaluated and the possibility of one impact or another occurring due to the level of abatement measures required in any given instance cannot reduce the level of impact. The Proposed Ordinance clearly states that it is the policy of the County to use abatement measures that could cause an organic farm to lose its organic certification, thereby rendering that farm unable to continue agricultural operations.²⁷

In the case of Be Wise Ranch, due to its location adjacent to the Lake Hodges Drinking Water Reservoir (“Hodges Reservoir”), the farm is required by its Lease with the City to only use organic agricultural practices. Therefore, a County requirement to spray pesticides will cause Be Wise Ranch to violate its lease with the City and require it to cease agricultural operations. The property would, therefore, be converted to open space, because only organic farming is allowed on the property. Therefore, a significant impact to agricultural resources would occur by converting Prime Agricultural Land to non-agricultural purposes and mitigation is required.

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²⁵ Ibid.

²⁶ Attachment M, AN ORDINANCE AMENDING THE SAN DIEGO COUNTY CODE OF REGULATORY ORDINANCES RELATING TO VECTOR CONTROL, § 1 (May 24, 2012) (as amended), *available at* http://www.sdcountry.ca.gov/deh/pests/pdf/Eye_Gnats/Att_A_Summary_of_changes_and_draft_ordinance_052412.pdf [hereafter PROPOSED ORDINANCE] [“It is the policy of the County to use regulatory authority or civil nuisance abatement litigation to require organic farming operations to take actions to control eye gnats that would cause the loss of organic farming certifications, or that would restrict the crops grown on a farm, only as a last resort.”].

²⁷ Ibid.

VII. LAND USE

The Proposed Ordinance will conflict with applicable land use plans, policies, and regulations of the City. The Negative Declaration proposes impacts and actions within the jurisdictional boundaries of the City, at Be Wise Ranch, but fails to analyze any of the land use plans, policies, and regulations of the City. At a minimum, an EIR must be completed to analyze these plans, policies, and regulations. Attachment E to the Negative Declaration only analyzes impacts on County land use ordinances. Because the Proposed Ordinance will apply to agricultural operations across the county and in various incorporated cities, the CEQA document must analyze plans, policies, and regulations from those cities affected. The following shows that the Proposed Ordinance will conflict with City of San Diego land use plans, policies and ordinances, and therefore significant impacts may occur and an EIR is required.

A. The Proposed Ordinance conflicts with the City's General Plan

1. GP Policy CE-A.2 – Reduce the City's carbon footprint. Develop and adopt new or amended regulations, programs, and incentives as appropriate to implement the goals and policies set forth in the General Plan to improve energy efficiency, especially in the transportation section and buildings and appliances

The Proposed Ordinance has the potential to eliminate a significant source of locally grown organic produce that is used in local stores such as Jimbo's and Trader Joe's. These food markets, which cater to customers seeking organic produce, will be forced to obtain their organic produce from outside the County, thereby decreasing the energy efficiency in the transportation sector and increasing greenhouse gas ("GHG") emissions. It is clear from empirical data that one of the largest contributors of GHG emissions is the number of Vehicle Miles Traveled ("VMT").²⁸ Increases in VMT create a corresponding increase in GHG emissions. Keeping sources of agricultural production close to where the produce will be delivered, consumed, and purchased, lowers overall VMT. In addition, preserving a local source of agricultural production reduces GHG emissions from other forms of transport such as ship and air.²⁹ The City's General Plan notes that, "urban agriculture . . . offers potential to . . . promote food security by reducing reliance on long-distance supply chains[] [and] reduce the amount of energy used to transport food[.]"³⁰

²⁸ E.g., Attachment N, Joanna D. Malaczynski & Timothy P. Duane, *Reducing Greenhouse Gas Emissions from Vehicle Miles Traveled: Integrating the California Environmental Quality Act (CEQA) with the California Global Warming Solutions Act* (2009) 36 Ecology L.Q. 71, 73, available at <http://www.boalt.org/elq/documents/elq36-1-02-duane-2009-0420.pdf>.

²⁹ Attachment O, NATURAL RES. DEF. COUNCIL, FOOD MILES: HOW FAR YOUR FOOD TRAVELS HAS SERIOUS CONSEQUENCES FOR YOUR HEALTH AND THE CLIMATE (2007), available at <http://www.nrdc.org/health/effects/camiles/foodmiles.pdf>.

³⁰ Attachment P, CITY OF SAN DIEGO, GENERAL PLAN CONSERVATION ELEMENT CE-44 (Mar. 2008), available at

Furthermore, the Proposed Ordinance allows the County to order the use of synthetic pesticides and fertilizers, as well as mandating certain agricultural practices. The scientific evidence has established that synthetic pesticides and fertilizers is a significant and substantial source of GHG emissions.³¹ Similarly, the scientific evidence has also established that organic farming practices, when compared to conventional or no-till farming practices, represent a significant reduction in GHG emissions because the practice of tilling in organic farming acts as a natural carbon sequestration system.³²

Be Wise Ranch not only provides thousands of pounds of organic produce to local markets, but also provides the organic produce directly to local homeowners through their Community Supported Agriculture ("CSA") Program. The CSA Program allows a family to pick up enough fresh produce for approximately 2 weeks at a neighbor's home within their community. This saves community members from making trips to local markets and further reduces VMT. The Proposed Ordinance could have the effect of eliminating organic agriculture on Be Wise Ranch through the mandatory spraying of pesticides to control eye gnats. The elimination of organic farming in this area would require markets and local homeowners to seek the same produce from sources further away and, therefore, increase VMT. Increases in VMT are contrary to the City's General Plan Policy to reduce the carbon footprint of the City, and therefore a significant impact may occur.

2. General Plan Policy CE-A.14 – Support expansion of urban agriculture to realize environmental, economic and public health benefits including: increasing access to fresh local food; reducing energy used for food transportation and distribution; and increasing opportunities for economic development and local enterprise

The Proposed Ordinance conflicts with this General Plan Policy because it will eliminate a significant source of locally grown organic produce available in stores such as Jimbo's and Trader Joe's and sold through the CSA Program, thereby reducing access to fresh local food. Elimination of locally grown food will increase energy used for food transportation and distribution and, as noted above, increase GHG and other emissions from transportation sources.

In addition, Be Wise Ranch is a locally owned and operated organic farm that contributes to the economic development of the City and represents an important source of local enterprise. The requirement to spray pesticides on the farm would cause the farm to lose its organic certification, and thereby disrupt the farm's business model and hinder this local enterprise from thriving. This directly conflicts with this General Plan Policy. This General Plan Policy seeks to

<http://www.sandiego.gov/planning/genplan/pdf/2012/ce120100.pdf> [hereafter CONSERVATION ELEMENT].

³¹ Attachment Q, NAT'L SUSTAINABLE AGRICULTURE COALITION, AGRICULTURE & CLIMATE CHANGE: IMPACTS AND OPPORTUNITIES AT THE FARM LEVEL 18 (2009), available at http://sustainableagriculture.net/wp-content/uploads/2008/08/nsac_climatechangepolicyreport_final_2009_07_16.pdf [hereafter NASC AGRICULTURE & CLIMATE CHANGE REPORT].

³² Id. at pp. 18–19.

support the expansion of urban agriculture to increase economic development. In the case of Be Wise Ranch, the farm is located on land owned by the City and provides lease revenue to the City. Therefore, elimination of farming operations through the requirement to spray agricultural pesticides would eliminate a revenue source for the City and would eliminate the economic "ripple-effect" from the wages paid to employees of the farm and the economic activity created by the selling of produce. A significant impact may occur.

3. General Plan Policy CE-D.3.e – Continue to participate in the development and implementation of watershed management plans. . . . Encourage proper sustainable agricultural practices such as tillage, use of grass filter strips, run-off detention basins, and organic farming³³

The Proposed Ordinance may require the use of agricultural pesticides that will preclude organic farming. This will have a significant impact on the General Plan Policy noted above. This General Plan Policy is notable because it implements the General Plan goal of "effective long-term management of water resources so that demand is in balance with efficient, sustainable supplies."³⁴ General Plan Policy CE-D.3.e provides a strategy to ensure safe drinking water supplies. Be Wise Ranch is located adjacent to the Lake Hodges drinking water reservoir. Therefore, the need to maintain organic farming practices at the farm to prevent pesticide run-off into a drinking water reservoir is of particular importance to the City. The CEQA document must analyze the potential impacts to drinking water quality and to this General Plan Policy as part of an EIR to determine whether a significant impact will occur. Because the City has made it a specific policy of the General Plan to encourage organic farming practices to implement protection and conservation of its drinking water reservoirs, the removal of these protections by the spraying of pesticides or the use of conventional agricultural practices that use pesticides would have a significant impact on this General Plan Policy, and mitigation is required.

4. General Plan Policy CE-E.2.e – Apply water quality protection measures to land development projects early in the process during project design, construction and operation in order to minimize the quantity of run-off generated on-site, the disruption of natural water flow and the contamination of storm water run-off. e) Maintain landscape design standards that minimize the use of pesticides and herbicides

Organic farming is the ultimate expression of this General Plan Policy because it precludes the use of pesticides and herbicides for the production of vegetables. The Proposed Ordinance would require pesticide spraying to reduce eye gnat populations that would maximize rather than minimize the use of pesticides on the site compared to the baseline. Therefore, a conflict between the Proposed Ordinance and the General Plan will occur, and significant impacts to both water quality and land use may occur.

5. General Plan Conservation Element Goal – Retention of productive agricultural lands

³³ CONSERVATION ELEMENT, *supra* note 30, at p. CE-24 (emphasis added).

³⁴ *Id.* at p. CE-21.

The Proposed Ordinance will conflict with this goal because the ordinance has the potential to transform Be Wise Ranch from a productive organic farming operation to open space or some other use. The City requires as part of the Lease that organic agricultural practices be maintained on the farm. The Proposed Ordinance could require the spraying of pesticides that would preclude organic agriculture on the site and therefore not retain these productive agricultural lands. Therefore, a significant impact will occur.

In addition, one of the practices that may be required by the Proposed Ordinance is that no organic matter be tilled into the soil. The effect of this practice would be that the soil's water holding capacity would slowly be depleted, which would lead to more erosion and untreated run-off into San Dieguito River and Lake Hodges, and eventually ruin the land for agricultural production. Implementing this practice could cause the elimination of productive farmland that is in direct conflict with this General Plan goal.

6. General Plan Conservation Element Goal – Greater use of sustainable agricultural practices

The Proposed Ordinance could require the spraying of agricultural pesticides on Be Wise Ranch. Organic farming is recognized as the most sustainable form of agriculture, because it uses natural farming practices that do not degrade the soil through the use of chemical pesticides. In addition, Be Wise Ranch provides fresh produce close to the consumers of that produce. The City's General Plan states clearly that "a core principal of sustainability involves meeting basic human needs, such as food, shelter, and water, via renewable sources as close to their consumption as possible."³⁵ The Proposed Ordinance would have the effect of ending organic farming on the site and, therefore, would create a direct conflict with this General Plan goal, because it would decrease the use of sustainable agricultural practices. Therefore, a significant impact will occur, and mitigation is required.

7. General Plan Policy CE-L.1 – Manage agricultural activity to minimize soil erosion and minimize the release of contaminants into surface and groundwater resources

The San Pasqual Valley is preserved for open space and agriculture and is primarily owned by the City Public Utilities Department due to the groundwater resources in the valley, and because it is the primary watershed for the Lake Hodges drinking water reservoir. The City has specifically required that agriculture at Be Wise Ranch be managed through organic practices. The Proposed Ordinance would require the spraying of chemical pesticides to abate eye gnats that would not "minimize the release of contaminants into surface [Lake Hodges] and groundwater [San Pasqual Valley] resources."³⁶ Because the Proposed Ordinance has the potential to significantly increase the amount of pesticides that are released from the Be Wise Ranch area (currently none), a conflict will occur with this General Plan Policy, and a significant impact will occur.

³⁵ Id. at p. CE-44.

³⁶ See id. at p. CE-45.

In addition, one of the practices that may be required by the Proposed Ordinance is that no organic matter may be tilled into the soil. The effect of this practice would be that the soil's water holding capacity would slowly be depleted, which would lead to more erosion and untreated run-off into San Dieguito River and Lake Hodges and eventually ruin the land for agricultural production. Implementing this practice would, therefore, increase soil erosion and increase the release of contaminants into surface waters, which is in direct conflict with this General Plan Policy.

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8. General Plan Policy CE-L.3 – Encourage agricultural operations such as community farms and gardens (especially on City-leased lands) to provide for educational experiences which demonstrate the history, importance and value of agricultural operations and to provide more healthy, sustainable, local food options

The Proposed Ordinance grants the County the authority to mandate the spraying of chemical pesticides on Be Wise Ranch. The use of chemical pesticides conflicts with sustainable agricultural principles and practices that underlie agricultural operations such as community farms and gardens, particularly on City-leased lands. The pesticide-free nature of agricultural operations at Be Wise Ranch support educational experiences for the local community that demonstrate the history, importance, and value of sustainable, healthy, and local agricultural operations and food options.

For example, Be Wise Ranch is participating in partnerships with local civic and educational organizations that promote this General Plan Policy. During the spring of each year, Be Wise Ranch hosts several different Girl Scout Troops for an educational tour. The Girl Scout Troops are given a tour of the packing facility as well as an outside tour of the farm. They have the opportunity to ask questions, walk the rows, and see and feel the produce in its natural state. In addition, Be Wise Ranch donates produce to these Girl Scout Troops to share with their families. Similarly, each week Be Wise Ranch works with Cardiff Elementary School, the Cardiff School District, and the Parent Teacher Association to incorporate organic produce into the school's lunch menu. Be Wise Ranch supplies weekly surplus harvest free of charge to be used in school lunches. These donations to the school continue during the school year (fall to summer). When the school year ends in the spring, Be Wise Ranch similarly collaborates with Cardiff Elementary Daycare until school resumes in the fall. Finally, Be Wise Ranch also collaborates with the UCSD Triathlon Team, which is the first collegiate team in the country to be certified as a sustainable and eco-friendly sports organization. As part of this certification, the Triathlon Team must serve local, organic produce as part of its post-race food, which Be Wise Ranch donates.

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The proposed use of chemical pesticides is inconsistent with encouraging agricultural operations that provide educational experiences demonstrating the history, importance, and value of healthy, sustainable, and local agricultural operations and food options. The Proposed Ordinance would have the effect of ending organic farming on the site and, therefore, creates a direct conflict with this General Plan Policy, because it would decrease the use of sustainable agricultural practices and the educational support throughout the County that Be Wise Ranch provides for these local organizations.

9. General Plan Policy CE-L.5— Integrate agriculture and sustainability principles that promote clean air and water, and healthy soils, habitats, and ecosystems

The Proposed Ordinance may require the spraying of pesticides on Be Wise Ranch. The use of pesticides will conflict with the sustainable agricultural principles that promote clean air and water, and healthy soils, habitats, and ecosystems, that currently occur on the organic Be Wise Ranch. The County is promoting practices that will not promote clean air, healthy habitats, or ecosystems. Pesticides are known to bioaccumulate in ecosystem food chains and cause disruption of animal birthing and death to many species.³⁷

Be Wise Ranch is located within the watershed of the Lake Hodges drinking water reservoir and within the City MHPA. The spraying of pesticides, potentially required by this ordinance, would potentially harm species within the MHPA preserve and could run-off into the adjacent Lake Hodges drinking water reservoir. Organic farming integrates agriculture and sustainability,³⁸ and the Proposed Ordinance would de-couple these agricultural practices from the sustainable practices currently in use.

In addition, one of the practices that may be required by the Proposed Ordinance is that no organic matter may be tilled into the soil. The effect of this practice would be that the soil's water holding capacity would slowly be depleted, which would lead to more erosion, contrary to the promotion of healthy soils that is part of this General Plan Policy.

- a. Encourage sustainable agricultural and water quality best management practices, such as tillage, use of grass filter strips, run-off detention basins, and organic farming, on all private land and require best management practices ("BMPs") on new or renewed City land leased for agricultural purposes. Provide the minimum amount of flood control/channelization³⁹

This General Plan Policy is very clear that organic farming practices implement the water quality and sustainability goals of the City. The Proposed Ordinance could require the spraying of pesticides on the farm that would preclude organic vegetable growing operations. The Negative Declaration ignores these significant impacts because it states that although organic farming operations may not be able to continue, conventional farming could continue and therefore no impact would occur. However, the City's General Plan Conservation Element policies clearly state a preference for organic farming. To preclude the use of organic farming through the mandatory spraying of pesticides is a direct, significant impact to the policies of the City's General Plan. Mitigation is required and an EIR must be completed to study these impacts.

³⁷ Attachment R, Environmental impact of pesticides, WIKIPEDIA, http://en.wikipedia.org/wiki/Environmental_impact_of_pesticides (last visited June 18, 2012).

³⁸ NASC AGRICULTURE & CLIMATE CHANGE REPORT, *supra* note 31, at pp. 18–19.

³⁹ CONSERVATION ELEMENT, *supra* note 30, at p. CE-45 (emphasis added).

private, that may affect the lands included within the boundaries of the San Pasqual Valley Plan area. Although the San Pasqual/Lake Hodges Community Planning Group is the City's officially-recognized community planning group for the San Pasqual Valley, per Council Policy 600-24, the Rancho Bernardo Community Planning Board has a long history of participation with land use issues related to the protection of the San Pasqual Valley, therefore will continue this role as well.⁴⁷

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Although the County is not a "city department," the County's lack of notice of issuance of the Negative Declaration has hindered City staff's ability to comply with this Council policy. Only after Be Wise Ranch contacted the City about the issuance of the Negative Declaration, and the City then contacted the County DPLU, did the County provide the Negative Declaration to the City. The lack of notice violates both the noticing provisions of CEQA, as well as the San Pasqual Vision Plan.

- D. The Proposed Ordinance is in conflict with the San Dieguito River Park Concept Plan (the "River Park Plan") and therefore significant impacts will occur

The San Dieguito River Park is governed by a joint powers authority of which the County and the City are members. The River Park Plan notes, "The San Dieguito River Valley Regional Open Space Park Joint Powers Authority ("JPA") is the agency empowered to plan and maintain the San Dieguito River Park. Specifically, the JPA has been empowered by its member agencies (the County and the Cities of Del Mar, Escondido, Poway, San Diego and Solana Beach) to acquire, hold and dispose of property for park purposes, to undertake overall planning for and to plan, design, improve, operate, manage and maintain the San Dieguito River Park. The JPA is further empowered to establish land use and development guidelines for the Park's FPA [(Focused Planning Area)]."⁴⁸

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1. Because this JPA is a governing land use authority in one of the primary areas impacted by the Proposed Ordinance, the JPA should have received notice of the Negative Declaration and have been given the opportunity to comment on the potential impacts

To our knowledge, no notice was provided to the JPA, and therefore the Negative Declaration must be re-noticed to this agency for a 30-day comment period. The lack of notice deprives this important agency of the ability to comment and participate in the CEQA process, which is contrary to the basic tenets of CEQA.

⁴⁷ POLICY 600-45, *supra* note 43, at p. 5.

⁴⁸ Attachment U, SAN DIEGUITO RIVER PARK JOINT POWERS AUTHORITY, SAN DIEGUITO RIVER PARK CONCEPT PLAN 5 (Feb. 15, 2002), *available at* <http://www.sdrp.org/archive/Concept%20Plan%20Revised2.pdf> [hereafter RIVER PARK PLAN].

2. The Proposed Ordinance presents potentially significant impacts to human health

Be Wise Ranch is located in landscape segment G of the San Dieguito River Park, and the Mule Hill Trail is adjacent to the farm. As noted in the River Park Plan, "The Mule Hill/San Pasqual Valley segment of the Coast to Crest Trail extends through this Landscape Unit for approximately 10 miles from the terminus of the North Shore Lake Hodges Trail to Highway 78 and Bandy Canyon Road. The trail provides interpretation of the historic events that took place at Mule Hill as well as the history of agriculture production in the valley."⁴⁹ The Proposed Ordinance will affect the Mule Hill Trail. Pesticide spraying at the farm will preclude use of the trail due to the potential for human health risks during spraying operations, and therefore significant impacts to land use and recreational resources will occur, and mitigation is required.

- E. The Proposed Ordinance is in conflict with the City MSCP, and therefore it will have significant impacts related to biological resources and land use resources

The Negative Declaration fails to analyze or review the City MSCP. Attachment E to the Negative Declaration only looks at the policies of the County MHPA and fails to evaluate the regulations and policies of the City MHPA area where pesticide spraying may occur. This is a clear deficiency in the analysis performed in the negative declaration, and an EIR must be completed to provide this analysis.

As shown below, numerous policies either would preclude the use of pesticides in the Be Wise Ranch area or would require significant mitigation. The Negative Declaration makes the presumption that actions to prevent pollution of sensitive biological areas will occur, without making note of the current environment. Be Wise Ranch is an organic farming operation that does not use toxic pesticides. The nature of this farming method is in itself a BMP, and other structural BMPs to prevent pesticide run-off are not needed because pesticides are not used. The Proposed Ordinance proposes to potentially change the nature of farming at Be Wise Ranch, with the mandatory spraying of toxic pesticides, which would require a completely new set of BMPs at the farm. The Negative Declaration fails to evaluate the impacts of the Proposed Ordinance on the current environment, and it fails to evaluate the new BMPs and mitigation measures that would be required due to the farm's location within the City MSCP. An EIR must be completed to evaluate these impacts.

1. Significant biological resources and habitat protected in the City's MSCP exist in the area of Be Wise Ranch and will be impacted by the spraying of chemical pesticides. Therefore, significant impacts may occur, and the preparation of an EIR is required.
 - a. Significant impacts to the federally endangered arroyo toad may occur

Be Wise Ranch sits on property owned by the City Public Utilities Department. The Lease with the City specifically acknowledges the location of the farm in the MHPA and

⁴⁹ Id. at p. 51.

requires that the farm “not use chemical fertilizers, pesticides or herbicides,”⁵⁰ because of potential harm to the federally listed, endangered arroyo toad, which lives and breeds in the area. The Lease states, “LESSEE has been advised and acknowledges that the boundaries of the leased premises are located in the CITY, Multiple Habitat Species Conservation Program (MSCP) Lake Hodges/San Pasqual Valley Cornerstone Lands . . . LESSEE will provide fencing that allows movement of the arroyo toads and keep agricultural operations out of the MHPA, not use chemical fertilizers, pesticides or herbicides, tilling will be reduced, when possible, and will preferably occur during the breeding season of the arroyo toad (March 15 to July 1).”⁵¹

Indeed, it is clear that there is a very high potential likelihood that a significant impact to the arroyo toad will occur from the implementation of this Proposed Ordinance that requires the spraying of chemical pesticides. The U.S. Fish & Wildlife Service warned, “[h]uman activities that may cause adverse impacts to arroyo toads include . . . the use of pesticides and herbicides within or adjacent to arroyo toad habitat.”⁵²

The Lease precludes the use of chemical pesticides because of the potential impacts to the arroyo toad, which is a federally listed, endangered species, yet the Negative Declaration fails to analyze the potential impacts that mandatory pesticide spraying would have on this endangered species.

- b. The City MSCP Subarea Plan notes that there are multiple sensitive and endangered species in the area of Be Wise Ranch, and the Negative Declaration fails to analyze or address any of these species

The City MSCP Subarea Plan, section 1.2.5, notes that the Lake Hodges/San Pasqual Valley area is an important wildlife corridor and is home to various sensitive species including the Least Bell’s Vireo, California Gnatcatcher, Cactus Wren, and the Encinitas Baccharis.⁵³ The area around the Be Wise Ranch area also supports the riparian habitat, coastal sage scrub, and grasslands, according to the City’s MSCP.⁵⁴

The MSCP Subarea Plan describes the area as an environmentally important and sensitive area:

The Hodges Reservoir/San Pasqual Valley core area represents one of the largest continuous blocks of habitat in the MSCP study area and serves as a major east-west corridor. This area includes core gnatcatcher and cactus wren populations, one of the two “centers of distribution” for Encinitas baccharis in the MSCP study area,

⁵⁰ Lease, *supra* note 14, § 9.4.

⁵¹ Ibid. (emphasis added).

⁵² *Arroyo Toad Critical Habitat*, *supra* note 12, at 9415.

⁵³ CITY MSCP SUBAREA PLAN, *supra* note 20, at pp. 28–34.

⁵⁴ Id. at p. 34 Figure 7.

large expanses of grassland that provide valuable raptor foraging habitat and valuable wetland habitat in San Pasqual Valley which supports several MSCP target species dependent on riparian habitats. The western portion of the valley, east of I-15 and above the drawdown area of the lake, is currently an intensively farmed agricultural preserve which has been cultivated since before this century.

The most important areas for conservation are those natural areas around Hodges Reservoir, the riparian habitat along the San Dieguito River and its tributaries through San Pasqual Valley, and the naturally vegetated slopes above the river valley. The majority of the riparian habitats in the river valley provide excellent opportunities for restoration and enhancement of the wildlife corridor through the valley. Conserved lands in the Hodges Reservoir/San Pasqual Valley area will be the cornerstone for a natural east/west open space corridor within the San Dieguito River Valley and San Pasqual Valley.⁵⁵

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The Negative Declaration for the Proposed Ordinance makes no effort to study or analyze the impacts that spraying chemical pesticides will have on the Be Wise Ranch or adjacent habitat areas in the MHPA. At a minimum, mitigation requirements would include adherence to MSCP adjacency guidelines. However, the Negative Declaration fails to even acknowledge the City MSCP as a guiding land use document and is therefore deficient in its analysis and conclusions. Significant impacts may occur from the actions required by the Proposed Ordinance, and therefore mitigation is required. An EIR must be prepared to thoroughly analyze these impacts.

2. The Proposed Ordinance has the potential to conflict with land use adjacency guidelines of the MSCP
 - a. The Proposed Ordinance conflicts with section 1.4.3 of the City MSCP

Section 1.4.3 of the City MSCP sets forth the requirement to prevent adverse impacts from chemical or by-product runoff to sensitive habitats and water:

Toxics[:] 2. Land uses, such as recreation and agriculture, that use chemicals or generate by-products such as manure, that are potentially toxic or impactful to wildlife, sensitive species, habitat, or water quality need to incorporate measures to reduce impacts caused by the application and/or drainage of such materials into the MHPA. Such measures should include drainage/detention basins, swales, or holding areas with non-invasive grasses or wetland-type native vegetation to filter out the toxic materials. Regular

⁵⁵ Id. at p. 29.

maintenance should be provided. Where applicable, this requirement should be incorporated into leases on publicly owned property as leases come up for renewal.⁵⁶

The Proposed Ordinance may require the spraying of chemical pesticides that are "potentially toxic or impactful to wildlife, sensitive species, habitat, or water quality."⁵⁷ As noted in the Negative Declaration, the toxicity of the proposed pesticides is well-established:

[T]hree of the pesticides proposed for use (Malathion, Diflubenzuron and Cyfluthrin) have been identified as toxic to aquatic organisms. The label for these pesticides imposes special restrictions, including requirements which prohibit direct application to water or run-off areas, a buffer zone requirement to prevent spraying closer than 25 feet to 450 feet (for ULV Aerial Application) from aquatic habitats.⁵⁸

Be Wise Ranch, which the ordinance proposes to regulate, is adjacent to riparian areas within the MHPA that support sensitive and endangered species. The MSCP requires the "incorporat[ion of] measures to reduce impacts caused by the application and/or drainage of such materials into the MHPA. Such measures should include drainage/detention basins, swales, or holding areas with non-invasive grasses or wetland-type native vegetation to filter out the toxic materials. Regular maintenance should be provided."⁵⁹

Be Wise Ranch is an organic farm and has not been designed with these BMPs to retain and filter polluted run-off from toxic chemicals used in pesticides, because the farm does not use pesticides. The Lease specifically requires organic farming, in order to reduce the impacts from pesticides on adjacent riparian areas. The pesticide spraying that may be required by the Proposed Ordinance will require mitigation measures consistent with the MSCP to prevent these toxic chemicals from reaching riparian areas. Therefore, a significant impact will occur. The Negative Declaration does not analyze these impacts and does not provide appropriate mitigation for the new impacts that may occur. In addition, due to the County's lack of land use authority within the City, it is questionable whether the County could require BMPs to be implemented, and therefore a significant and unmitigable impact may occur.

- b. The Proposed Ordinance conflicts with the MSCP section 1.5.9 – Specific Management Policies and Directives for Lake Hodges and the San Pasqual Valley Background Goals and Objectives

As noted in MSCP section 1.5.9, "[t]he optimum future condition for the Lake Hodges/San Pasqual Valley area would be a mosaic of native habitats and compatible farming and recreational activities that act to preserve and rejuvenate healthy natural ecosystems and

⁵⁶ CITY MSCP SUBAREA PLAN, *supra* note 20, at p. 47.

⁵⁷ *Ibid.*

⁵⁸ INITIAL STUDY, *supra* note 6, at p. 19.

⁵⁹ CITY MSCP SUBAREA PLAN, *supra* note 20, at p. 47.

processes, water quality, and the full range of native species.”⁶⁰ To that end, section 1.5.9 notes that “[t]he major issues that require consideration for management in the San Pasqual Valley, based on the existing conditions as described in section 1.2, are the following in order of priority: 2. Non-sustainable agriculture, including dairy and grazing operations, and associated activities such as chemical applications and storage.”⁶¹

The application of chemical pesticides that could be required by the Proposed Ordinance would exacerbate one of the “major issues” identified in the preservation of habitats in the preserve area. In addition, as noted above, the City’s General Plan identifies organic farming as a sustainable agricultural practice. The Proposed Ordinance would prevent Be Wise Ranch from continuing this sustainable agricultural practice and therefore transform a sustainable agricultural operation into a non-sustainable agricultural operation, which is in conflict with the City MSCP. Therefore a significant impact will occur.

VIII. AIR QUALITY

The Proposed Ordinance will have significant impacts on air quality compared to the baseline, and therefore an EIR is required.

A. The Negative Declaration uses an inappropriate baseline for its review

The Negative Declaration finds that there will be no impact to air quality because the ordinance proposes the spraying of conventional agricultural pesticides on agricultural areas in compliance with state and federal rules. However, the Negative Declaration appears to assume that some level of pesticide spraying has historically taken place at the property. Be Wise Ranch is an organic farm that does not use conventional agricultural pesticides. The San Pasqual Valley Community Plan notes that this property has had a history of organic farming of squash. Therefore, there is no history of pesticide spraying on the parcel, and the baseline for impacts to air quality in the area must be analyzed against a history of no pesticide use.

B. The Proposed Ordinance has the potential to impact sensitive receptors

The Negative Declaration provides no analysis of whether there is the potential for sensitive receptors to be impacted by pesticide spraying required by this ordinance. The Negative Declaration provides a good history of enforcement actions by the Department of Agricultural Weights and Measures but does not actually look at where sensitive receptors are located in relation to the farming operations to determine if they would be impacted by pesticide spraying.

As noted above, the Mule Hill Trail, which is part of the Coast to Crest trail, runs directly adjacent to Be Wise Ranch. The trail is open to the public and is enjoyed by families throughout the year. The Negative Declaration provides no analysis and no mitigation to avoid impacts to children who may be using the trail with their family during or after pesticide spraying events. According to the San Dieguito River Park JPA web site, the trail is used for hiking, mountain

⁶⁰ Id. at p. 86.

⁶¹ Id. at p. 87.

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biking, and horseback riding.⁶² The multi-use nature of this trail, along with its low level of difficulty, make it attractive to family use and could expose sensitive receptors to pesticides required under this ordinance.

Various homes adjacent to Be Wise Ranch are less than 200 feet from the farm, and therefore sensitive receptors in those homes (old and young persons, persons with respiratory illness, etc.) could be exposed to pesticides that may be sprayed on Be Wise Ranch because of this Proposed Ordinance. Santa Ana winds are prevalent in the San Pasqual Valley and may provide a vehicle for significant pesticide drift if pesticides are applied during or just before a wind event. The Negative Declaration does not analyze the impact of the prevalent Santa Ana winds on pesticide spraying or how they could increase impacts to sensitive receptors.

continued

IX. GREENHOUSE GAS EMISSIONS

- A. Be Wise Ranch provides locally grown produce to local homes and markets, which prevent the need for long-haul shipping of vegetables from other parts of California or from other countries

The Proposed Ordinance has the potential to eliminate a significant source of locally grown organic produce that is used in local stores such as Jimbo's and Trader Joe's. These food markets, which cater to customers seeking organic produce, will be forced to obtain their organic produce from outside the County, thereby decreasing the energy efficiency in the transportation sector and increasing GHG emissions. It is clear from empirical data that one of the largest contributors of GHG emissions is the number of VMT.⁶³ Increases in VMT create a corresponding increase in GHG emissions. Keeping sources of agricultural production close to where the produce will be delivered, consumed, and purchased, lowers overall VMT. In addition, preserving a local source of agricultural production reduces GHG emissions from other forms of transport such as ship and air.⁶⁴ The City of San Diego's General Plan notes that, "urban agriculture . . . offers potential to . . . promote food security by reducing reliance on long-distance supply chains[] [and] reduce the amount of energy used to transport food[.]"⁶⁵

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Furthermore, the Proposed Ordinance allows the County to order the use of synthetic pesticides and fertilizers, as well as mandating certain agricultural practices. The scientific evidence has established that synthetic pesticides and fertilizers is a significant and substantial source of GHG emissions.⁶⁶ Similarly, the scientific evidence has also established that organic farming practices, when compared to conventional or no-till farming practices, represents a

⁶² Attachment V, Trails in the San Dieguito River Park, SAN DIEGUITO RIVER PARK JOINT POWERS AUTHORITY, <http://www.sdrp.org/trails.htm> (last visited June 18, 2012).

⁶³ E.g., Malaczynski & Duane, *supra* note 28, at p. 73.

⁶⁴ NATURAL RES. DEF. COUNCIL, *supra* note 29.

⁶⁵ CONSERVATION ELEMENT, *supra* note 30, at p. CE-44.

⁶⁶ NASC AGRICULTURE & CLIMATE CHANGE REPORT, *supra* note 31, at p. 18.

significant reduction in GHG emissions because the practice of tilling in organic farming acts as a natural carbon sequestration system.⁶⁷

Be Wise Ranch not only provides thousands of pounds of organic produce to local markets, but also provides the organic produce directly to local homeowners through their CSA Program. The CSA Program allows a family to pick up enough fresh produce for approximately 2 weeks at a neighbor's home within their community. This saves community members from making trips to local markets and further reduces VMT. The Proposed Ordinance could have the effect of eliminating organic agriculture on Be Wise Ranch through the mandatory spraying of pesticides to control eye gnats. The elimination of organic farming in this area would require markets and local homeowners to seek the same produce from sources further away, and therefore increase VMT. Increases in VMT are contrary to AB32 standard to reduce GHG emissions to 1990 levels by 2020. The San Diego County GHG Emission Inventory⁶⁸ recommends at least a 10% reduction in VMT to achieve the AB32 requirements to reduce emissions below "business-as-usual" emission levels. As noted earlier, the Proposed Ordinance will have the effect of requiring additional VMT for the transportation of substitute organic produce to homes and markets in the County from outside the County and the country. Current CSA members will also be forced to travel outside their neighborhoods to obtain organic produce, thus increasing overall VMT.

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X. HAZARDS

The Proposed Ordinance will require pesticide spraying on organic farming operations that do not currently use agricultural pesticides and are, therefore, not set-up with the necessary infrastructure to support hazardous material storage of pesticides. The Negative Declaration determines that there will be no risk because agricultural operations are required to follow regulations on the handling of pesticide materials. This assumes that there is on-going pesticide application at a given site, staff is familiar with these regulations, and facilities are available for the storage and handling of pesticide materials. As noted, organic farming does not use agricultural pesticides, and therefore the risk of a release of hazardous material is increased by the unfamiliarity with regulations and the lack of facilities for these pesticides.

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XI. HYDROLOGY AND WATER QUALITY

- A. The Proposed Ordinance could result in pesticide spraying adjacent to a Clean Water Act section 303(d) listed water body

The Proposed Ordinance could result in the spraying of agricultural pesticides, three of which (Malathion, Diflubenzuron and Cyfluthrin) are acknowledged in the Negative Declaration as being "toxic to aquatic organisms." The San Diego Regional Water Quality Control Board has

⁶⁷ Id. at pp. 18-19.

⁶⁸ See Attachment W, Sean Tanaka, SAN DIEGO COUNTY GREENHOUSE GAS INVENTORY, AN ANALYSIS OF REGIONAL EMISSIONS AND STRATEGIES TO ACHIEVE AB 32 TARGETS, ON-ROAD TRANSPORTATION REPORT 8 (Sept. 2008), *available at* <http://catcher.sandiego.edu/items/epic/GHG-On-Road1.pdf>.

listed Lake Hodges and the San Dieguito River as impaired water bodies on the 303(d) list⁶⁹ for various pollutants, including toxicity. The Negative Declaration provides no analysis of the proposed pesticide spraying on these 303(d) listed water bodies and how they could be protected from potential run-off.

As noted throughout this comment letter, the Negative Declaration appears to assume that all agricultural operations currently spray pesticides and therefore have BMPs and other structural devices to deal with pesticides. Be Wise Ranch is an organic farm and does not use pesticides. The Lease with the City of San Diego specifically precludes the use of pesticides on the farm to protect the water quality of the San Dieguito River, Lake Hodges, and the San Pasqual Groundwater Basin. The Proposed Ordinance could, therefore, require the farm to take actions that are less protective of the impaired water bodies in the area, resulting in a significant impact.

In addition, one of the practices that may be required by the Proposed Ordinance is that no organic matter may be tilled into the soil. The effect of this practice would be that the soil's water holding capacity would slowly be depleted, which would lead to more erosion and untreated run-off into San Dieguito River and Lake Hodges. The San Diego Regional Water Quality Control Board has placed these water bodies on the 303(d) list as being impaired for turbidity and dissolved solids, which are caused by increased erosion. Implementing the practices contemplated by the Proposed Ordinance would, therefore, increase soil erosion and increase the release of contaminants into surface waters exacerbating an issue for which these water bodies are already impaired.

At a minimum, the mere fact that the actions in the Proposed Ordinance could cause a significant impact to a 303(d) listed water body should have triggered notification of the Negative Declaration to the San Diego Regional Water Quality Control Board for their comments.

B. The Proposed Ordinance could expose the Hodges Reservoir to pesticides

The San Pasqual Valley is preserved for open space and agriculture and is primarily owned by the City Public Utilities Department due to the groundwater resources in the valley and because it is the primary watershed for the Hodges Reservoir. The City has specifically required that agriculture at Be Wise Ranch be managed through organic practices. The Proposed Ordinance would require the spraying of chemical pesticides to abate eye gnats that would not "minimize the release of contaminants into surface [Lake Hodges] and groundwater [San Pasqual Valley] resources."⁷⁰ Because the Proposed Ordinance has the potential to significantly increase the amount of pesticides that are released from the Be Wise Ranch area (currently none), a conflict will occur with this General Plan Policy, and a significant impact will occur.

In addition, one of the practices that may be required by the Proposed Ordinance is that no organic matter may be tilled into the soil. The effect of this practice would be that the soil's

⁶⁹ 303(D) LIST, *supra* note 10, at pp. 18-20, 85.

⁷⁰ See CONSERVATION ELEMENT, *supra* note 30, at p. CE-45.

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water holding capacity would slowly be depleted, which would lead to more erosion and untreated run-off into San Dieguito River and Lake Hodges and eventually ruin the land for agricultural production. Implementing this practice would therefore increase soil erosion and increase the release of contaminants into surface waters, which is in direct conflict with this General Plan Policy.

XII. RECREATION

Be Wise Ranch is located in the San Dieguito River Park, an open space park that includes hiking, biking, and horseback riding trails. The Mule Hill Trail runs adjacent to Be Wise Ranch and is part of the larger Coast to Crest trail system. The potential pesticide spraying would necessarily require closure of the Mule Hill Trail during pesticide spraying to protect human health. This would affect the public's ability to utilize this recreational resource, therefore creating a significant impact that must be analyzed in an EIR.

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continued

A.8

From: "Blackson, Kristin" <Kristin.Blackson@sdcounty.ca.gov>
Subject: Please print
Date: August 15, 2012 10:31:12 AM PDT
To: 'Howard Blackson' <howard@placemakers.com>

From: Farahnaz [mailto:farahnazf@gmail.com]
Sent: Wednesday, July 18, 2012 3:04 PM
To: Lafreniere, Rebecca
Subject: Re: Eye Gnat Ordinance and Program

Reconsider the changes to the San Diego Vector Control Report

Organic farming and Be Wise Ranch is under attack from residents who are upset regarding eye gnats. By classifying eye gnats as a County issue it takes control out of the farmers' hands and puts it into yet to be decided officials. We realize that the residents of Escondido and the adjacent community deserve and should be able to enjoy the outdoors without the threat of eye gnats. However, we do not believe that this ordinance is fair and balanced. It will take the efforts of us here at the farm as well as a community wide trapping program to be instituted in order to reduce the nuisance of the eye gnats.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

We object to 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

We object to 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board. This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

We ask that more research be done before changing the laws in the Vector sector.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

We object to 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

We object to 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board. This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

I realize that the residents of Escondido and the adjacent community deserve and should be able to enjoy the outdoors without the threat of eye gnats. However, I do not believe that this ordinance is fair and balanced. It will take the efforts of us here at the farm as well as a community wide trapping program to be instituted in order to reduce the nuisance of the eye gnats.

Section 64.403 states the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

Please change Section 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

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Please change section 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board. This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

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This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

Regards,
Farahnaz



THE CITY OF SAN DIEGO

A.3

June 20, 2012

San Diego County Department of Environmental Health.
5570 Overland Drive Suite 102, San Diego, CA 92123

Submitted via email to: eyegnat@sdcounty.ca.gov.
Hard Copy to follow.

Subject: CITY OF SAN DIEGO COMMENTS ON THE NOTICE OF INTENT TO ADOPT A NEGATIVE
DECLARATION FOR THE EYE GNAT ORDINANCE AND PROGRAM

The City of San Diego ("City") has received and reviewed the Negative Declaration for the above project and appreciates this opportunity to provide comments to the San Diego County Department of Environmental Health.

Staff from the City of San Diego have reviewed the Negative Declaration and have the following comments:

TRANSPORTATION & STORM WATER DEPARTMENT

Ruth Kolb
Program Manager
RKolb@sandiego.gov
858-541-4328

The City of San Diego understands that eye gnats are a nuisance and potential public health concern; however, the actions taken to eliminate these situations cannot cause or contribute to water quality exceedances. Therefore, comments regarding the Hydrology and Water Quality section are being submitted:

IX.(a): Violate any waste discharge requirements? Determination: Less than Significant Impact
The city disagrees with determination of Less than Significant Impact, and recommend that it be changed to Less than Significant with Mitigation Incorporated. The lower 19 miles of the San Dieguito River are listed on the Clean Water Act 40 CFR Section 303(d) List of Water Quality Limited Segments (2010) as impaired for toxicity. The Water Quality Control Plan for the San Diego Region, Chapter 2 Beneficial Uses, Inland Surface Waters section, Page 2-12 states "*Those water not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary.*" Due to this listing and the potential of the toxicity from the proposed use of pesticides is a concern within this watershed; particularly synthetic pyrethroids are one of the listed pesticides. Cyfluthrin, a synthetic pyrethroid, and Diflubenzuron bind



Neighborhood Code Compliance Division

1222 First Avenue, 5th Floor, MS 511 • San Diego, California 92101-4101
Tel (619) 236-5500 Fax (619) 533-6142

to the soil particles and are easily transported to our waterways, moving downstream during storm events if Best Management Practices (BMPs) are not properly implemented.

This section cited an approval by the California Secretary of the Resources Agency in 1979 as a basis for their determination. Now this responsibility is under the authority of the California Department of Pesticide Regulation (DPR) that has implemented a Surface Waters Protection Program. This program protects human health and the environment by preventing pesticides from adversely affecting our surface waters, by addressing both agricultural and nonagricultural sources of pesticide residues in surface waters. This program assists with determinations of potential adverse effects to surface water quality. An overview of the program is found on their website at <http://www.cdpr.ca.gov/docs/emon/surfwtr/overvw.htm>.

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IX.(b): Is the project tributary to an already impaired water body, as listed on the Clean Water Act Section 303(d) list? If so, could the project result in an increase in any pollutant for which the water body is already impaired? Determination: Less than Significant Impact

The city disagrees with determination of Less than Significant Impact, and recommend that it be changed to Less than Significant with Mitigation Incorporated. The lower 19 miles of the San Dieguito River are listed on the Clean Water Act 40 CFR Section 303(d) List of Water Quality Limited Segments (2010) as impaired for toxicity. The Water Quality Control Plan for the San Diego Region, Chapter 2 Beneficial Uses, Inland Surface Waters section, Page 2-12 states "*Those water not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary.*" Due to this listing and the potential of the toxicity from the proposed use of pesticides is a concern within this watershed; particularly synthetic pyrethroids are one of the listed pesticides. Cyfluthrin, a synthetic pyrethroid, and Diflubenzuron bind to the soil particles and are easily transported to our waterways, moving downstream during storm events.

IX.(c): Could the proposed project cause or contribute to an exceedance of applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses? Determination: Less than Significant Impact

The city disagrees with determination of Less than Significant Impact, and recommend that it be changed to Less than Significant with Mitigation Incorporated. The lower 19 miles of the San Dieguito River are listed on the Clean Water Act 40 CFR Section 303(d) List of Water Quality Limited Segments (2010) as impaired for toxicity. The Water Quality Control Plan for the San Diego Region, Chapter 2 Beneficial Uses, Inland Surface Waters section, Page 2-12 states "*Those water not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary.*" Due to this listing and the potential of the toxicity from the proposed use of pesticides is a concern within this watershed; particularly synthetic pyrethroids are one of the listed pesticides. Cyfluthrin, a synthetic pyrethroid, and Diflubenzuron bind to the soil particles and are easily transported to our waterways, moving downstream during storm. The California Department of Pesticide Regulation (DPR) has the authority to regulate pesticides and implements a Surface Waters Protection Program. This program protects human health and the environment by preventing pesticides from adversely affecting our surface waters, by addressing both agricultural and nonagricultural sources of pesticide residues in surface waters. This program assists with determinations of potential adverse effects to surface water quality. An overview of the program is found on their website at <http://www.cdpr.ca.gov/docs/emon/surfwtr/overvw.htm>.

DEVELOPMENT SERVICES DEPARTMENT:

Brian Schoenfisch

Senior Planner

BSchoenfisch@san diego.gov

619-533-6457

1) The Negative Declaration should take into consideration City of San Diego Council Policy 600-45, which calls for the protection of water, agricultural, biological and cultural resources within the San Pasqual Valley. Beginning in the 1940's, the San Pasqual Valley was purchased by the City of San Diego for water-supply purposes. The underlying purpose of Council Policy 600-45 is to protect the public's investment in water resources within the Valley by using land around Lake Hodges and its watershed for agriculture uses which are compatible with the vision to protect water quality. Therefore, in accordance with the Council Policy, the Negative Declaration should consider that the quality of the surface water and groundwater basin will be ensured. Any potential impacts to the quality of the surface water or groundwater basin should be analyzed.

2) The Negative Declaration should also take into consideration the San Pasqual Valley Plan (Adopted in 1995, amended in 2005), which also contains numerous policies relating to the protection of water resources in the San Pasqual Valley. Page 12 contains the following language:

Water Resources

Hodges Reservoir is currently a limited public water supply and is in the process of becoming a future source of water for City of San Diego. Pesticides, fertilizers, recycled groundwater used in agriculture, dairy farming and urban runoff from surrounding land uses within the Hodges Reservoir watershed may be compromising ground and surface water quality.

Source Water Protection Guidelines (January 2004) for New Development provide ways to ensure that Best Management Practices are implemented to reduce pollutants of concern from entering the reservoir. These include nutrients and organic carbons.

Additionally, page 95 includes the following language:

Water Quality

Measures for avoidance of agricultural impacts on water quality may include but are not limited to proper tillage practices, the use of grass filter strips, runoff detention basins, chemical spill catchment basins, proper use of chemicals and fertilizers, use of new and less impacting products, encouragement of organic farming and monitoring of farming practices by the City.

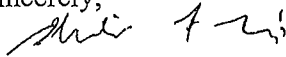
Appropriate best management practices shall be developed on a case-by-case basis by the City's Agricultural Assets Manager and the lessees in coordination with the Water Utilities Department.

The Negative Declaration should address any potential impacts to the above policy language.

3.) In 2005 the City of San Diego established the San Pasqual Land Use Task Force, whose purpose is to devote its focus to issues which affect the integrity and preservation of the Valley by ensuring that all proposals are compatible with the protection of water quality. The San Pasqual Land Use Task Force should be included on the distribution of the Negative Declaration.

Please contact the appropriate above-named individual(s) if you have any questions on the submitted comments. The City respectfully requests that you please address the above comments in the Negative Declaration and provide an electronic copy of the document for distribution to the commenting department. If you have any additional questions regarding the City's review of the Negative Declaration, please contact Philip Lizzi, Associate Planner at 619-446-5159 or via email at plizzi@sandiego.gov

Sincerely,



Philip Lizzi
Associate Environmental Planner
Development Services Department

cc: Ruth Kolb, Program Manager, Transportation and Stormwater Department
Brian Schoenfish, Senior Planner, Development Services Department

A.4

From: Dorthi Wormser [dorthi@cox.net]
Sent: Saturday, June 02, 2012 12:46 PM
To: LUEG, DEH-Eyegnat
Cc: Cindy Morriss
Subject: Att'n: Eye Gnat Ordinance and Program

(Have copied and pasted a reply to you from an Allegro neighbor:
Dorothy Wormser)

It appears our community is only getting one side of the story on the eye gnat issue, so I figured I would lend a voice of reason to the situation.

This proposes ordinance change would give the county the ability to require an organic farm to use conventional chemical fertilizer, which would eliminate their status as an organic farm and destroy their livelihood. I believe a farm has to be completely chemical free for seven years to qualify as a certified organic farm. It's good to know that people are so easily willing to ruin a business because of some bugs.

The idea that Cindy Morriss and her Eye Gnat Committee are "not anti-organic, just pro-ordinance" is total junk. The complete shortsightedness of this attempt to change an ordinance that will give the county the legal right to require the use of chemical fertilizers on organic farms, and hiding it under the pretense that this is really just so entomologists can "monitor" the farm is laughable. This is like saying we're okay giving our state legislators the power to raise taxes and expect them not to. This ordinance would give them the authority to do so (fertilizer) and you can all be sure they would exercise this authority if they desired.

For the life of me I can't figure out why so much energy has been spent on eye gnats when it should be spent on filling the darn lake. Property value decline because of bugs? Really?

Come on...doesn't anyone think that having a lake view in front of their house would impact their property value a heck of a lot more than bugs?

Below is a portion of my response to the county regarding the ordinance listed below.

The County of San Diego is attempting to modify an ordinance that:

- a. Puts the health of its people in jeopardy by reducing available organic food options, you know, like how all food used to be grown before about 1945.
- b. Impacts the livelihood of a perfectly legal (and some might say noble) business.
- c. Requires no actual proof that eye gnats are caused by organic farms. The land next to (and including?) Be Wise Farms in Escondido is protected land by the State of California State, and is designated as such because of the Eye Gnat Catcher bird population. I'm pretty sure the state just protect the land for birds to eat eye gnats caused by an organic farm.
- d. Ignores common sense. There is a large lake (Hodges) next to the farm and all of the houses that contain the people who are complaining about the eye gnats. Attached to the lake on the east end is a swamp-like area. Now I'm no biologist or entomologist, but I'm pretty sure a swamp breeds more bugs than a farm. Furthermore, the swamp at the east end of Lake Hodges is there because the county and state can't figure out how to fill it correctly and remove all of the dead trees that grew when we ignored the lake for so long. I submit that the state

and county are the chief culprits of the growing eye gnats because they have failed to address correctly filling the lake.

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Thanks,

Andrew Pidduck

Allegro Resident

From: TIFFANY FRIEDLUND [tiffandrew@yahoo.com] **Andrew Pidduck**
 Sent: Saturday, May 26, 2012 10:11 AM
 To: LUEG, DEH-Eyegnat
 Cc: Slater, Pam; Ron-Roberts; Jacob, Dianne; Cox, Greg; Horn, Bill; Miller, Jack
 Subject: Eye Gnats Ordinance

Hello,

I am writing to address the profound shortsightedness of the Department of Environmental Health, and potentially, the County of San Diego. In reading your website regarding the eye gnat issue (I live off of Concerto Glen in the area in question) I can't help but wonder whose influence the county is really succumbing to. I would like to point out that eating safe, organic food is important to a lot of people, not just environmentalists and the stereotypical "farmers market guy."

I have multiple points to address the language in the Negative Declaration: "Changes to the Ordinance as it was previously released for public review from January 31, 2012 to February 10, 2012 would still not authorize the DEH to require the use of conventional pesticides on organic crops..."

1. Requiring an organic farm to use conventional fertilizer eliminates their status as an organic farm and destroys their livelihood.
2. This approach is incredibly shortsighted. Do we really think it's a good idea to put poison (it is that, you know...after all it does kill pests and bugs) in our food and watersources because of a small nuisance? Has the county even bothered to address its comfort with being responsible for eliminating organic farms in San Diego County, and spraying chemicals within 100 feet of my house and Lake Hodges? See point one above – you can't use chemical fertilizer on an organic farm and still call it organic, and you can't spray fertilizer on a farm right next to a lake and not expect it to run off into the lake. The lake is also a drinking water source for many residents of San Diego, including Rancho Santa Fe. Ms. Slater-Price and Mr. Horn, are you two really comfortable with the families in your districts drinking water that contains chemical fertilizers? I sure wouldn't be...
3. The County of San Diego has absolutely no right to dictate ordinance on state land (the Be Wise Farm, the farm in question leases state land).
4. The County of San Diego is attempting to modify an ordinance that:
 - a. Puts the health of its people in jeopardy by reducing available organic food options, you know, like how all food used to be grown before about 1945.
 - b. Impacts the livelihood of a perfectly legal (and some might say noble) business.
 - c. Requires no actual proof that eye gnats are caused by organic farms. The land next to Be Wise Farms in Escondido is protected land by the State of California State, and is designated as such because of the Eye Gnat Catcher bird population. However, this land has been designated as protected land long before Be Wise Farms existed in that location. How is it possible that this farm is causing eye gnats to exist? I'm pretty sure the state didn't protect the land for birds that had no food to eat in anticipation of an organic farm existing there in the future.
 - d. Ignores common sense. There is a large lake (Hodges) next to the farm and all of the houses that contain the people who are complaining about the eye gnats. Attached to the lake on the east end is a swamp-like area. Now I'm no biologist or entomologist, but I'm pretty sure a swamp breeds more bugs than a farm. Furthermore, the swamp at the east end of Lake Hodges is there because the county and state can't figure out how to fill it correctly and remove

all of the dead trees that grew when we ignored the lake for so long. I submit that the state and county are the chief culprits of the growing eye gnats because they have failed to address correctly filling the lake.

I look forward to attending the next public hearing on this manner. Thank you for listening to my points.

Regards,

Andrew Pidduck
Escondido, CA
619-203-1063

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contin

A.6

From: Robert Bugg [robert_bugg@me.com]
Sent: Monday, June 18, 2012 1:08 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Supervisor Bill Hom; Councilman Carl DeMaio; Steve Danon; Dave Roberts; Bill Brammer; Joseph Patt; Joseph Patt; Daniel Cohen; Richard Smith
Subject: Comment on Eye Gnat Ordinance and Program – Negative Declaration
Attachments: Bugg_EyeGnat_Comment.pdf; ATT00001.htm

Jack Miller

Department of Environmental Health

5570 Overland Avenue, Suite 102

San Diego, CA 92123

eyegnat@sdcounty.ca.gov

June 18, 2012

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller:

Please find attached my comment on the Eye Gnat Ordinance and Program - Negative Declaration.

Also, please confirm by email reply your receipt of this message.

Thanks very much,

Sincerely,

Robert L. Bugg, Ph.D.
Entomologist
1552 Pinnacles Place
Davis, CA 95616-6660
530-219-7834
robert_bugg@me.com

Via E-mail: eyegnat@sdcountry.ca.gov

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

June 18, 2012

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller:

Here are my comments on the proposed San Diego County "Negative Declaration and Initial Study" regarding eye gnats (*Liohippelates collusor* [Townsend], *Liohippelates* spp., and *Hippelates* spp. (Diptera: Chloropidae).

I have a Ph.D. in entomology from UC Davis, and have extensive experience in research, extension, and implementation of sustainable agricultural practices, including least-toxic pest management, cover cropping, hedgerow design and establishment, biological control, native pollinator conservation, and ecological soil management. I have authored over fifty refereed scientific publications on these and related themes. I have worked with a wide range of crops, including alfalfa, vegetables, potatoes, pecans, almonds, walnuts, and winegrapes. I was co-originator and implementer of the Biologically Integrated Orchard Systems (BIOS) projects, which involved farmer-to-farmer exchanges and farmer-scientist teams and were the first multi-media agricultural pollution reduction projects in the USA. I also co-originated the Biologically Integrated Farming Systems competitive grants program, which expanded this approach to numerous crops in California.

I am undertaking this work for Mr. Brammer on a *pro bono* basis because I believe that his case has great merit and that public policy should be based on the best science and reasonable process.

I am very concerned about the proposed negative declaration and the 2010 and 2011 reports (by Mr. Bethke, the U.C. Cooperative Extension Floriculture and Nursery Farm Advisor, San Diego County, and colleagues) on which this proposed negative declaration is based. My general concerns are:

- (1) The proposed negative declaration essentially identifies Be Wise Ranch as the sole source of the eye gnat problem, when a reasonable reading of the relevant studies, including some of Mr. Bethke's, would indicate that residential plantings, the golf course, seasonal wetlands, and the San Dieguito River are all major sources. The situation calls for reasoned, community-wide, integrated approaches rather than draconian measures against Be Wise Ranch. Long ago, Dr. E.F. Legner and Dr. E.C. Bay, both entomologists at UC Riverside, wrote about the

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importance of an integrated, *community-wide* approach to eye gnat issues, and these statements should provide guidance in the present case. A unified, community-wide effort is necessary to permanently abate the problem (Legner, E.F. & Bay, E.C. 1970. *Hippelates* eye gnat breeding in the Southwest. California Agriculture 24(5):1, 4-6.). Bay and Legner (Bay, E.C. & Legner, E.F. 1963. The prospect for the biological control of *Hippelates collusor* (Townsend) in southern California. Proceedings of the California Mosquito Control Association, Inc. 31:76-79) also wrote of the importance of eye gnat breeding habitats *other* than tilled agricultural fields: "*Hippelates* are more dependent on living grasses than heretofore realized . . . disturbed sandy soil, although an important breeding site, is less a prerequisite to *Hippelates* development than commonly thought . . .". Similarly, Dr. Mir S. Mulla (Mulla, M.S. 1962. The breeding niches of *Hippelates* gnats. Annals of the Entomological Society of America 55(4):389-393) reported that, in addition to breeding in irrigated, tilled farmland, eye gnats also reproduce in certain non-tilled areas, including golf courses, new lawns, ditch banks, canal shoulders, and alfalfa-barley fields.

- (2) Mr. Bethke and colleagues have used sampling regimes that have not systematically assessed important *Liohippelates collusor* breeding habitats in The Vineyard Golf Course and associated seasonal wetlands. These omissions include failure to locate emergence traps in the irrigated, middle portions of the golf course fairways, where divots, sand additions, irrigation, and abundant dead, green matter (comminuted by mowing) combine to produce excellent habitat for *Liohippelates*. Mr. Bethke and colleagues have instead restricted their emergence trap placement to the periphery of fairways, where disturbance, plant growth, divots, sand introduction, irrigation, and plant growth are all much less. It is simply not legitimate to extrapolate count data from such traps to the entire golf course.
- (3) As represented in the 2010 report, Mr. Bethke and colleagues have largely ignored the San Dieguito River bed as a potential source of *Liohippelates collusor*. Specifically, Mr. Bethke and colleagues only placed two emergence traps in the riverbed, and these were positioned in roadside settings that are certainly not representative of the riverbed as a whole. Rather, the traps were positioned in a roadside setting that does not entail much water or vegetation, or disturbance regimes typical of the riverbed as a whole. Earlier studies have shown that stream banks are major breeding sites for eye gnat (see point 1 above).
- (4) The proposed negative declaration dictates large increases in the collar trap density over the density originally proposed by the Floriculture and Nursery Farm Advisor. These increases appear to be arbitrary and, again, not based on sound experimental design, analysis, and interpretation. The proposed negative declaration would also cause a great increase in cost to the farmer not only because of the increase in density but also because they would include within-field traps that are difficult to maintain than those on the field edges and on the farm perimeter. Mr. Bethke's original recommendation, contained in email messages to Mr. Brammer of January 11 and 12, 2012, was for 2,000 collar traps arranged on the perimeter of the farm, at intervals of 10' - 30', depending on which crops were growing and whether the field was covered with plastic mulch.

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By contrast, in the 2011 report (issued in May 2012), in the recommendation for eye gnat control for Be Wise Ranch, the number, for reasons unspecified, was increased to 6,900 collar traps to be arrayed in two offset rows of at 10' apart, plus 43 collar traps per acre in all tilled fields. In addition, all dried and green matter was stipulated to be removed from the farm. No scientific basis has been provided for the increases in trap densities or the other changes. The original plan requires ca \$600 per acre, whereas the arbitrarily and capriciously revised plan would cost upwards of \$3,500 per acre, and would render strawberry production a net loss operation of \$2,500 per acre. The proposed management regimes will make it economically impossible to farm organically in Escondido. This has been clearly established through data provided by Bill Brammer of Be Wise Ranch.

- (5) The insecticide Ecotrol does not work against eye gnat based on Mr. Bethke's data (2010 report, tables 4, 5, 6), yet Ecotrol is prescribed for alternate-week spraying under the proposed negative declaration.
- (6) In the 2010 report, Mr. Bethke and colleagues have presented count data from collar traps in a very misleading manner, including the truncation of a graph (Fig. 4) that, if presented in full, would show that by far the highest eye gnat densities are encountered at sites miles away from Be Wise Ranch, including one site immediately adjoining Kit Carson Park.
- (7) The practices promoted in the proposed negative declaration are at marked variance with trapping regimes successfully used in Coachella, CA, and Yuma, AZ, in which cases a single trapline is maintained along the agricultural-suburban interface, with additional traps in parks and golf courses.
- (8) If the proposed policy is implemented, the organic farmer will immediately be found to be out of compliance; will have no further regulatory recourse; will have to undertake costly, ineffective practices that will put him in violation of his lease and in violation of Organic production standards; will be forced to undertake practices that impair surface waters; and, ultimately, will be put out of business.
- (9) 2012 sampling by Mr. Bethke has shown a 98% reduction in counts of eye gnats in five collar traps on The Vineyard Golf Course, including traps that immediately adjoin Be Wise Ranch. This suggests that the traplines and other control measures already in place on the farm are working excellently (Bryan Vander Mey, Staff Research Associate, UC Cooperative Extension, FAX message, June 13, 2012). This information further suggests that the additional burdensome, unreasonable, and ineffective measures and practices envisioned under the proposed negative declaration would be superfluous and should be rejected.

In summary, based on readily available science, the proposed negative declaration is seriously flawed and should be rejected. If implemented, the proposed negative declaration will drive a highly productive organic farm out of business and will definitely *not* solve the eye gnat problem in Escondido. This would occur at a time when collar trap sampling is clearly showing the current practices at Be Wise Ranch are drastically reducing the incidence of eye gnats emanating from the farm. Solving the eye gnat problem in the long run will require a conscientious, sober, community-wide commitment and systematic control efforts in other major breeding habitats in the area,

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complementing the excellent and effective efforts that have already been made by Bill Brammer and his colleagues at Be Wise Ranch.

Thank you for considering my comments.

Sincerely,

Robert L. Bugg, Ph.D.
Entomologist
1555 Pinnacles Place
Davis, CA 95616-6660
C 530-219-7834
Robert_bugg@me.com

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continue

From: sharon escher [shaesc00@gmail.com]
Sent: Monday, June 18, 2012 1:59 PM
To: LUEG, DEH-Eyegnat; DEH, Vector; diane.jacob@sdcounty.ca.gov; Slater, Pam; Cox, Greg; Roberts, Ron
Subject: Comments to Eye Gnat Ordinance Program

Linda Hollingsworth, Project Manager
Department of Environmental Health
5570 Overland Ave
Suite 102
San Diego, CA 92123
eyegnat@sdcounty.ca.gov
vector@sdcounty.ca.gov
diane.jacob@sdcounty.ca.gov
pam.slater@sdcounty.ca.gov
greg.cox@sdcounty.ca.gov
ron.roberts@sdcounty.ca.gov

June 18, 2012

Attention: Eye Gnat and Ordinance Program

I would like to comment on impact results of the proposed Eye Gnat Ordinance Initial Study and Negative Declaration.

Below are 4 points I would like to see addressed.

1. Why were only aquatic organisms addressed in the environmental hazards section of the pesticide labels? If land crops are being sprayed, should not the hazards of spraying on the land be addressed, which impact land organisms such as mammals, bees and other beneficial insects, and birds? The impact of spraying weekly and the percolating of the pesticide into groundwater should also be discussed. Why were these issues not addressed?
2. Section IV of the biological resources document on page 18, line 15 states "that as long as label restrictions are adhered to, the infrequent application as needed of these pesticides would not have a significant direct or cumulative impact to biological resources, including sensitive species". From the "Bornt Farms 2010 Eye Gnat Nuisance Prevention Plan", a weekly spraying on the buffer crop is mandated. Is the weekly mandate according to the label? Does this weekly mandate adhere to the "infrequent application" as required by Section IV to have no significant impact?
3. The last line on page 7 in chemical control, states "therefore we must conclude that the organic pesticides recommended in the 2010 Eye Gnat Nuisance Prevention Plan were ineffective and should not be required in the 2011 plan." But the 2011 final report San Diego County Eye Gnat Research

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and Education Project Escondido Chemical Control (page 7) states, "At present, applications of registered organic oils, such as Ecotrol/Ecotec (rosemary oil and peppermint oil) or an application of Entrust (spinosad) should be applied every other week to production crops throughout the cropping cycle. Applications of Ecotec will reduce, in part, eye gnat adult populations." If the 2010 recommendation was that organic pesticides were ineffective to control eye gnats, why does the Final 2011 report say it should still be used? What facts were being used to make the 2011 final report? Why was it recommended that Bornt Farm spray Ecotrol EVERY week if it is ineffective? Using conventional pesticides would cancel the organic certification. I would rather have an infrequent-as needed application on my organic vegetables than a weekly build up of peppermint and rosemary oil. I would prefer that nothing be applied to my organic vegetables, and therefore would recommend that the highly effective method of trapping be used, as has been effective in Borrego, Yuma, and other areas (see item 4 below).

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4. In the "Recommendations for the Eye Gnat Nuisance Prevention Plan for Be Wise Ranch in Escondido 2012 Based on Research Conducted During 2011", page 7 under the heading Trapping, it says "Removing the adult eye gnats from the population is a highly effective tactic in reducing eye gnat population numbers in Cochella Valley and in Jucumba." This proven, recommended method should be implemented San Diego County.

In conclusion, I do not want conventional pesticides used on my food: I buy organic at a higher price for this reason. The environmental impact of conventional pesticides on buffer crops in the Initial Study and Negative Declaration has not been adequately addressed. In the Initial Study and Negative Declaration, weekly mandated spraying and every-other week recommended spraying on the Bornt Farm and Be Wise Ranch production crops, respectively, does not adhere to the the "infrequent, as necessary" statement. If all references to pesticides were eliminated from the proposed eye gnat ordinance, a Negative Declaration would indeed be correct.

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The ordinance should be changed to use the traps that have been proven to be highly effective in removing adult eye gnats from the population. Let the farmer determine what his customers want and act accordingly while following pesticide regulation.

Sharon Escher
559 Donax Ave
Imperial Beach, CA 91932
shaesc00@gmail.com

Dr. Marina Frants
4024 Crystal Dawn Ln.#102
San Diego, CA 92122
mfrants@ucsd.edu

Sarilee Anderson
5935 La Jolla Hermosa

La Jolla, CA 92037
sanderson@ucsd.edu

Megan Scanderbeg
5453 White Oak Lane
San Diego, CA 92130

A.8

From: "Blackson, Kristin" <Kristin.Blackson@sdcounty.ca.gov>
Subject: Please print
Date: August 15, 2012 10:31:12 AM PDT
To: 'Howard Blackson' <howard@placemakers.com>

From: Farahnaz [<mailto:farahnazf@gmail.com>]
Sent: Wednesday, July 18, 2012 3:04 PM
To: Lafreniere, Rebecca
Subject: Re: Eye Gnat Ordinance and Program

Reconsider the changes to the San Diego Vector Control Report

Organic farming and Be Wise Ranch is under attack from residents who are upset regarding eye gnats. By classifying eye gnats as a County issue it takes control out of the farmers' hands and puts it into yet to be decided officials. We realize that the residents of Escondido and the adjacent community deserve and should be able to enjoy the outdoors without the threat of eye gnats. However, we do not believe that this ordinance is fair and balanced. It will take the efforts of us here at the farm as well as a community wide trapping program to be instituted in order to reduce the nuisance of the eye gnats.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

We object to 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

We object to 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board. This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

We ask that more research be done before changing the laws in the Vector sector.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

We object to 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

We object to 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

I realize that the residents of Escondido and the adjacent community deserve and should be able to enjoy the outdoors without the threat of eye gnats. However, I do not believe that this ordinance is fair and balanced. It will take the efforts of us here at the farm as well as a community wide trapping program to be instituted in order to reduce the nuisance of the eye gnats.

Section 64.403 states the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

Please change Section 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

Please change section 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board. This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

We object to 64.403 where it states that the Director can ask to override all of the protective language in the ordinance and ask the Eye Gnat Abatement Appeals Board to set aside these limitations.

We object to 64.403 (c) and (d). These 2 sections will almost guarantee that the farm would have to close down because it would not be economically feasible to farm.

We object to 64.407 (d). This gives the Director unlimited power to shut down a farm with the approval of the Appeals Board This much authority is too great a power to give to the Director when we have no idea how the Appeals Board will function or who the County will install in these positions.

This proposed ordinance is all based on community complaints and there is no scientific way at this time to measure the success or failure of the eye gnat program that is being proposed. We have no idea what the base amount of the endemic level of eye gnats were prior to Be Wise Ranch farming here in the San Pasqual Agricultural Preserve. We have received numerous letters and emails from long time residents adjacent to the farm as well as farmers here in the San Pasqual Valley that assert that eye gnats have always been an issue here.

Regards,
Farahnaz

Tom Escher
2615 Sunset Hills
Escondido, CA 92025
Phone: (760) 445 9533 cell

Linda Hollingsworth, Project Manager
Department of Environmental Health
5570 Overland Ave
Suite 102
San Diego, CA 92123
eyegnat@sdcounty.ca.gov
<http://www.sdcounty.ca.gov/deh/index.html>

REC'D JUN 19 12

Attention: Eye Gnat and Ordinance Program

Thank you for the opportunity to comment on the proposed eye gnat ordinance and program. The biological resources section IV was checked a "less than significant impact." However, only aquatic organisms listed on the environmental hazards section of the pesticides labels were addressed. Bees, wild mammals, birds and groundwater are also on the environmental hazards section and should be addressed.

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Example:

Acephate: Toxic to birds, wild mammals and bees.
Cyromazine: Ground water and bees
Cyfluthrin: Bees
Diflubenzuron: Terrestrial juvenile insects
Malathion: Bees

Attachment B, Best Management Practices, Eye Gnat Control on Organic Farms on the last page under various combinations of options states that "the trap/barrier crop should be treated weekly." It explains further "for best results, use acephate and malathion, which are organophosphates, and cyfluthrin a pyrethroid. These products should be rotated between the organophosphates and the pyrethroid so that no single chemical is applied in succession. Resistance development is common in eye gnats."

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Questions

- What was the rationale for choosing these 5 conventional pesticides?
- How much residue is left on alfalfa, the preferred trap/barrier crop after spraying weekly from "April 1st to October 31st?" (Born't Farms 2012 Eye Gnat Nuisance Prevention Plan)
- How should the trap/barrier crop be used?
- What affect will weekly spraying have on beneficial insects?
- What are the accumulative affects on the land where the trap/barrier crops are planted?

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Furthermore, eye gnats and trap/barrier crops are not listed on pesticide labels. Alfalfa is listed but the pest does not have to be listed. Spraying of a trap/barrier where there is not a pest of the trap/barrier crop might be considered a legal application but could also be thought of as circumventing the intent of pesticide regulations, i.e. apply less pesticides, not more.

Section IV of the biological resources document (page 18 line 15) states, "therefore, as long as label restrictions are adhered to, the infrequent application, as needed, of these pesticides would not have a significant direct or cumulative impact to biological resources, including sensitive species."

Questions

- How can label restrictions be adhered to when the Director of Environmental Health is enforcing what pesticide to use and when to use them?

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- Why was enforcing weekly spraying on the buffer crop considered "infrequent"? (See Bornt Farms 2012 Eye Gnat Nuisance Prevention Plan)? "Infrequent" is correct if referring to organic certification, one application of any of the 5 pesticides, or any other conventional pesticide to organic production crops would cancel the growers organic certification.
- What is meant by "as needed"? Does that refer to controlling gnats that fly through the trap/barrier crop or some alfalfa pest?

In addition the document states, "Illegal application is extremely unlikely for a pesticide application required to be made under a Department of Environmental Health (DEH) order." The following scenario puts doubt on that statement.

The final report, San Diego County eye Gnat Research and Education Project 2010 on page 16 (results) states that Ecotrol (Ecotec) and Entrust suggest that there can be an affect by these pesticide, but at rates much higher than label rates and a much greater cost than is feasible.

Page 7 last line in chemical control, "therefore we must conclude that the organic pesticides recommended in the 2010 Eye Gnat Nuisance Prevention Plan were ineffective and should not be required in the 2011 plan". However, the 2011 final report San Diego County Eye Gnat Research and Education Project Escondido Chemical Control (page 7) states, "At present, applications of registered organic oils, such as Ecotrol/Ecotec (rosemary oil and peppermint oil or an application of Entrust (spinosad)) should be applied every other week to production crops throughout the cropping cycle. Applications of Ecotec will reduce, in part, eye gnat adult populations."

Also, the Bornt Farms 2012 Eye Gnat Nuisance Prevention Plan states that "production crops will be treated weekly with an organic pesticide or not plant production crops within 1000 feet from the edge of town." Ecotec and Entrust are not listed on the plan. "County vector control program will conduct weekly random inspections to monitor compliance with the plan."

The term Last Resort has been written and talked about so much that is has become a myth. The myth is that eye gnats will be controlled by spraying with conventional pesticides. Eye gnats are killed when they come in contact with the spray. Flying adults that do not come in contact with the spray will continue their life cycle of gathering mucus and laying from 200 to 400 eggs. Weekly spraying of trap/barrier crops has not been proven to be the preferred method for controlling eye gnats. A recent letter from Chris Summer, District Entomologist, Yuma County Pest Abatement District, University of Arizona, states that "spraying to control adults is ineffective."

Another myth is that conventional farmers (not organic farmers) using conventional pesticides will control eye gnats. Simplified, farmers plant crops and hope they don't have to spray. They continually look for pests that would affect the crop. When a pest is observed, a conventional pesticide that will control the pest is applied and the farmer hopes he won't have to spray again. Farmers spray only as needed. Eye gnats are not pests and farmers do not and will not spray for them on an as needed schedule.

Research has proven that trapping is highly effective in controlling eye gnats. There no pesticides involved as the attractant to the traps is putrefied eggs in water.

Recommendations

If the pesticide impact is thoroughly addressed, the initial study could justifiably be changed from a "less than significant impact" to a "less than significant impact with mitigation incorporated." The mitigation would be to eliminate all pesticides and pesticide related requirements from the proposed ordinance. Then, efforts could be channeled to implement a community eye gnat trapping program patterned after other areas that have had similar programs for many years, i.e. Borrego Water District, Yuma, etc. University of California co-operative extension could organize the program and it would be win-win, everyone working together and much more farmer-community friendly.

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A.10

From: Kay [kaytaff@sbcglobal.net]
Sent: Saturday, June 16, 2012 6:15 PM
To: LUEG, DEH-Eyegnat
Cc: Ron-Roberts
Subject: Do Not Use Pesticides on Eye Gnats at Organic Farms

Dear County of San Diego,

I am writing in opposition to the proposal to promote the use of non-organic pesticides at Be Wise Ranch or any other organic farm, on the pretext that this action will reduce eye gnat swarms.

I earned a BA in biology from UC Riverside and an MA in biology from CSU Fresno. For the first fifteen years of my life I was a research technician in biological research. Three of those years was spent supporting plant pathology research for the USDA, three in oceanographic plankton studies, and the remainder in various other natural resource studies. I then completed an additional course of study in landscape architecture, and passed the state of California licensing exams to become a registered landscape architect in California in 1989. In short, I have a professional understanding of how science can provide useful information to public agencies. I also have learned how politics can interfere with agencies making sound decisions in the public interest.

The proposal to use pesticides that are not approved for organic agriculture in order to subdue eye gnats is an example of proposing bad public policy, based not on science, but on pressure from a few noisy, self-interested people. Eyegnats are not disease vectors. They are not harmful to health, though they are an unpleasant nuisance when people are in their proximity. I was in the midst of a swarm of tiny flies at a national wildlife refuge in Oregon once and it drove me into my tent for the evening. My husband and I witnessed multiple huge swarms of tiny gnats rising from the coastal sage scrub in Tecolote Canyon a couple of years ago, miles from any agriculture. He has photos of this phenomenon, backlit by the afternoon sun, and when he had to bicycle through a swarm, he got gnats in his mouth and eyes.

So I personally know that gnats do swarm, and are annoying; no-one else in this discussion denies that fact. However, the County has not provided convincing evidence indicating that gnat swarms are a product of any particular agricultural practices. Despite this, the County is proposing using non-organic pesticides in an effort to reduce the gnats that have swarmed in one place, Be Wise Ranch. I am positive that the public interest would be harmed by doing so.

My husband (who was born in San Diego) and I have been buying organic food for decades. To help others grow healthy uncontaminated food, I helped establish a community garden as a volunteer, helped with the community garden at the campus I attended, and in my practice as a licensed landscape architect in the state of California, I encourage the use of IPM and organic growing practices in the landscapes that I design professionally. Most pertinent to this discussion, I support the farmers who grow organic food in San Diego County by buying local organic produce whenever possible. I am very grateful for their knowledge, good business sense, and hard labor, that results in healthy food for people like us.

I feel the job of our public agricultural agencies is to be sure that agricultural practices produce healthy food for people and do not harm the environment at large. The public interest would best be served by ignoring those people who are annoyed by eye gnats. They can close their doors during those brief periods when gnats swarm. If that doesn't do it for them, they are free to move away if they don't like living where the gnats sometimes are found. It is as simple as that. They have no special right to convince the County to take actions that are harmful to many others just to reduce their annoyance.

I lived by farms for three years near Salinas and Watsonville, while working on my masters degree in biology. Those times when the farming practices were annoying, I stayed away from home longer hours: I worked late. I never felt that my being constantly comfortable was the County of Monterey's job, unlike these people in San go County who have asked for its intervention to keep eye gnats out of their personal space.

I have been deeply disappointed by our public agencies approving use of so many chemical pesticides. I am convinced that an alliance between agencies and corporate agrichemical business hurts people and the environment that we live in and that we will leave when we are no longer alive. The latest proof is the destruction of bees by neonicotinoid pesticides such as Imidacloprid. This byproduct of tobacco (cigarettes are not its only nasty product) was patented by Bayer and earns them over a billion dollars every year; hence, several copy-cat pesticides are now sold by other agrichemical corporations. Our environment is being destroyed by non-organic agriculture, and our people are being made unhealthy. Americans suffer obesity, diabetes, brain and other cancers that used to be quite rare, MS, joint ailments, and a plethora of other diseases which are coinciding (and most think NOT coincidentally) with a poisoned environment and unhealthy food.

I entreat you very sincerely: do not approve pesticide use on eye gnats near any farms in San Diego County.

Kay Stewart, CA Landscape Architect # 2967
2171 India Street Suite A San Diego CA 92101
www.kaylarch.com
619-234-2668

A.11

From: danielle thomas [daniellet96@yahoo.com]
Sent: Tuesday, June 19, 2012 9:05 AM
To: LUEG, DEH-Eyegnat
Subject: Fw: Att: Eye Gnat Ordinance & Program-Negative Declaration Response-Environmental Review No. 12-00-001

----- Forwarded Message -----

From: danielle thomas <daniellet96@yahoo.com>
To: "eyegnat@sdcounty.gov" <eyegnat@sdcounty.gov>
Cc: Bill Pape <billjacum@aol.com>; "Amber.Tarrac@sdcounty.ca.gov" <Amber.Tarrac@sdcounty.ca.gov>; Lafreniere Rebecca <rebecca.lafreniere@sdcounty.ca.gov>; "rickshawjr@hotmail.com" <rickshawjr@hotmail.com>; joe marshall <joe.marshall@att.net>; Moon Barnet <jacumbamoon@aol.com>; Howard Cook <howwcook@yahoo.com>; Miller Jack <jack.miller@sdcounty.ca.gov>; "dave@deanzasprings.com" <dave@deanzasprings.com>; "helen@deanzasprings.com" <helen@deanzasprings.com>; Mark Ostrander <clasictraclayer@att.net>
Sent: Tuesday, June 19, 2012 9:02 AM
Subject: Att: Eye Gnat Ordinance & Program-Negative Declaration Response-Environmental Review No. 12-00-001

(Minor change but please replace earlier version with this revised document. I typed Manzanita wetlands instead of Mesquite)

Monday, June 18, 2012 11:22 PM

To Whom it May Concern: First, let me say that I appreciate all the man hours and work that went into the preparation of the provided documents. My comments are not meant as a criticism to any individual but more as a reaction to the Jacumba community's & my frustrating experiences throughout this entire eye gnat abatement fight and Ordinance process.

I would like to mention up-front that giving the public over 100 pages to download or absorb on-line and comment on within 20 days is beyond the pale. (14 pages of Summary of changes, 24 pages of the Ordinance showing changes in red, 70 pages of Negative Declaration Initial Study . . .) Not everyone knows what CEQA is and none of our residents that received the letter and subsequently called me, understood what a Negative Declaration is or how they were expected to respond. Some of the changes in the Ordinance itself are difficult for a lay person to comment on since, as everyone knows, in a legal document even the choice of outwardly nearly identical words and/or placement of comma's can change legal meanings.

Here are my comments:

Changes in Ordinance

2) In the Draft Ordinance changes, #17, Page 5 of 14 under Revised or Relocated text last sentence) I believe that the addition of the words: "Last resort orders will remain appealable to the Eye Gnat Abatement Board if and when being issued" goes diametrically against the Supervisors wishes that the Eye Gnat Abatement Board be an ADVISORY BOARD only at this critical step and that some County official (in this case it would probably be Jack Miller in his role of Director DEH) have final decision making authority. I believe if this isn't the legal intent of the final Ordinance it will have no teeth. Please respond back to me with clarification on whether the board is just advisory on LAST RESORT orders and where in the Ordinance it spells this out.

3) In the Draft Ordinance changes, #24, Page 9 of 14 under Revised or Relocated Text, section 235.1 Membership and Selection. I would like to see the words " and not involved with blogging or writing about the Organic Industry inserted. We had an Organic Blogger and supposed (unbiased) consultant on the Ordinance Board that was clearly hostile to the community representatives and basically said we just needed to "live with" the problem. Also, I believe it important that the two community members selected to serve, be selected from a pool of candidates selected by the Planning Groups or Sponsor Groups of the communities. Otherwise there is a high likelihood that the decks will be stacked against the communities from the beginning.

4) In the Draft Ordinance Changes, #13, page 4 of 14 Original text h)middle of the paragraph statement that says "and evidence provided by the community into account", can

you include: acceptable evidence may include phone complaints, dated pictures and videos and results from eye gnat netting

Negative Declaration

My understanding of CEQA is that it is a law passed in the 1970's that requires state and local agencies within California to follow a protocol of analysis and public disclosure of environmental impacts of proposed projects; to adopt all feasible measures to mitigate those impacts; and that CEQA mandates actions all state and local agencies must take to advance that policy. What I don't understand after reading the Negative Declaration is

why a CEQA Analysis was not required prior to allowing Alan Bornt (Bornt Farms and land-owner Jacumba Valley Ranch) and Bill Brammer (Be Wise Ranch) to initiate farming.

Although both businesses were similar to that of businesses that occupied the space before, there are significant differences in how they farm and treat the land because (mostly) of their organic status.

In the case of Bornt Farms, he expanded the acreage of the farm way beyond what had been done before, grew different crops than had been grown before and used the water resources differently. I do not understand why the County has allowed him to operate even though he was and is still in violation of CEQA. I would like a response to this in writing

Specifically: I believe that Bornt Farms has had significant environmental impacts in the areas of

1. VIII-Hazards and Hazardous Materials (see the section concerning "placing residents adjacent to an existing or reasonably foreseeable use that would substantially increase current or future residents exposure to vectors, including mosquitoes, rats or flies which are capable of transmitting public health disease or PUBLIC NUISANCE [emphasis is mine]"

2. IX Hydrology & Water Quality c) "could the project cause a deficit in the aquifer or interference with groundwater discharge?" ((Bornt has drained two wells dry and the farm is now out of water]

3. VVIII Mandatory findings of Significance a) "Does the project have the potential to degrade the quality of the environment substantially reducing the habitat of fish or wildlife (during his farming tenure, all the water has drained all from a once beautiful Mesquite wetlands area adjacent to Carrizo Creek-this is a sad loss of habitat for our birds and coyotes) b) "Does the project have impacts that are limited but cumulatively significant?" A big YES where Bornt Farms is concerned

Communities such as Jacumba and Escondido are fighting for economic and quality of Life survival with little or no help from our County. Sadly, everything I have experienced in this process has indicated to me that the County will bend over backwards to protect large commercial farms even as these farms cause AVOIDABLE and DEVASTATING economic and quality of life issues to neighboring communities. This is so wrong on so many levels. While I do believe we need an Ordinance, I unfortunately still feel that this particular Ordinance does nothing to solve the current problems in Escondido and Jacumba. However, it may serve as a deterrent to new large organic farms thinking of moving adjacent to communities and destroying them.

Sincerely, Danielle Cook -Jacumba Resident

From: danielle thomas [daniellet96@yahoo.com]
Sent: Monday, June 18, 2012 11:23 PM
To: LUEG, DEH-Eyegnat
Cc: Bill Pape; Tarrac, Amber; rickshawjr@hotmail.com; Moon Barnet; Mark Ostrander; joe marshall; Bill Dennett (principal); Lafreniere, Rebecca; Miller, Jack
Subject: Att: Eye Gnat Ordinance & Program-Negative Declaration Response-Environmental Review No. 12-00-001

To Whom it May Concern: First, let me say that I appreciate all the man hours and work that went into the preparation of the provided documents. My comments are not meant as a criticism to any individual but more as a reaction to the Jacumba community's & my frustrating experiences throughout this entire eye gnat abatement fight and Ordinance process.

I would like to mention up-front that giving the public over 100 pages to download or absorb on-line and comment on within 20 days is beyond the pale. (14 pages of Summary of changes, 24 pages of the Ordinance showing changes in red, 70 pages of Negative Declaration Initial Study . . .) Not everyone knows what CEQA is and none of our residents that received the letter and subsequently called me, understood what a Negative Declaration is or how they were expected to respond. Some of the changes in the Ordinance itself are difficult for a lay person to comment on since, as everyone knows, in a legal document even the choice of outwardly nearly identical words and/or placement of comma's can change legal meanings.

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4) In the Draft Ordinance Changes, #13, page 4 of 14 Original text h)middle of the paragraph statement that says "and evidence provided by the community into account", can you include: acceptable evidence may include phone complaints, dated pictures and videos and results from eye gnat netting

Negative Declaration

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advance that policy. What I don't understand after reading the Negative Declaration is why a CEQA Analysis was not required prior to allowing Alan Bornt (Bornt Farms and land-owner Jacumba Valley Ranch) and Bill Brammer (Be Wise Ranch) to initiate farming. Although both businesses were similar to that of businesses that occupied the space before, there are significant differences in how they farm and treat the land because (mostly) of their organic status.

In the case of Bornt Farms, he expanded the acreage of the farm way beyond what had been done before, grew different crops than had been grown before and used the water resources differently. I do not understand why the County has allowed him to operate even though he was and is still in violation of CEQA. I would like a response to this in writing

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Communities such as Jacumba and Escondido are fighting for economic and quality of Life survival with little or no help from our County. Sadly, everything I have experienced in this process has indicated to me that the County will bend over backwards to protect large commercial farms even as these farms cause AVOIDABLE and DEVASTATING economic and quality of life issues to neighboring communities. This is so wrong on so many levels.

While I do believe we need an Ordinance, I unfortunately still feel that this particular Ordinance does nothing to solve the current problems in Escondido and Jacumba. However, it may serve as a deterrent to new large organic farms thinking of moving adjacent to communities and destroying them.

Sincerely, Danielle Cook -Jacumba Resident

From: Diane Gage [dianegage@gmail.com] on behalf of Diane Gage [dgage@san.rr.com]
Sent: Saturday, June 16, 2012 4:27 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; roberts@sdcounty.ca.gov; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com; info@bobfilnerformayor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Attn: Jack Miller, Department of Environmental Health

I request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate & provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

I am currently a member of the Be Wise Ranch CSA, which provides fresh vegetables to me at a pick-up site in my neighborhood. The proposed ordinance gives the County authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch. **This will mean the end of Be Wise Ranch's organic status**, an end to the healthy, fresh *AFFORDABLE* produce the farm provides for me and my family, and a loss of productive farm land.

Besides depriving me of a major *AFFORDABLE* source of my diet and nutrition, the spraying of pesticides will negatively impact the plants and animals in the San Pasqual Valley. While the proposal attends to County policies, the fact of that matter is that Be Wise Ranch and the San Pasqual Valley are in the CITY of San Diego. The SPV is a San Diego City open space park and agricultural preserve that supports endangered and threatened species. Organic farming methods are in harmony with the protection of species such as the Least Bell's Vireo and the California Gnatcatcher, while spraying pesticides is most likely not. Surely no pesticides should be applied until their impact is adequately studied and analyzed!

It is my understanding that eye gnat populations are DOWN considerably at the golf course this year compared to a couple of years ago. This would suggest that the Be Wise Ranch mitigation efforts are working, so why the rush to push through this ordinance without a proper environmental review?

Please consider the significant impacts to the health of families and the environment that will be created by the proposed ordinance. Not to mention the loss of a valuable San Diego business, thereby causing harm to its owners, workers and San Diego area customers. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this proposed ordinance.

Thank you
Diane Gage
2541 Meadow Lark Drive
San Diego, Ca 92123

From: Diane Gage [dianegage@gmail.com]
Sent: Thursday, May 24, 2012 2:03 PM
To: County of San Diego; LUEG, DEH-Eyegnat
Subject: Re: County of San Diego Eye Gnats, Countywide Update

Comment on notification below:

I strongly object to the proposed Eye Gnat Program and Ordinance as described in the May 24, 2012 email notification.

My specific concern has to do with giving DEH the power to require the use of conventional pesticides on organic farms. The phrase "except as a last resort" means that DEH COULD require the use of conventional pesticides on organic farms. Although the email statement says DEH could NOT order that farms be closed, using any conventional pesticide (never mind "only" five) would have exactly that effect. So there is a contradiction in terms here.

No organic farm can maintain its organic certification once conventional pesticides are in use, for whatever reason. Therefore issuing an order to use a conventional pesticide would have exactly the same consequence as ordering the farm to close down its business. (In which case, mightn't the County be exposing itself to litigation?)

My understanding of this eye gnat issue is that this change in the ordinance is UNNECESSARY because the eye gnat nuisance can be reduced through other means that do not destroy thriving businesses in San Diego County and the livelihoods, goods and services they provide to San Diego citizens.

Thank you for your attention.

Diane Gage
San Diego

From: Sheri Mayer [sherimayer@gmail.com]
Sent: Saturday, June 16, 2012 9:33 PM
To: County of San Diego
Cc: LUEG, DEH-Eyegnat; Steve@stevedanon.com
Subject: Eye Gnat Ordinance and Program
Attachments: Eye Gnat Negative Declaration 06-16-12.doc

Hello,

Please see my attached comment in response to the email sent to me below. Please notify me if the attachment cannot be viewed and I will be happy to resend. Thank you.

Kind regards,
Sheri Mayer

On Fri, Jun 1, 2012 at 10:47 AM, County of San Diego <sdcounty@service.govdelivery.com> wrote:

You are receiving this notification because of your interest in eye gnat and organic farming issues in San Diego County.

The Department of Environmental Health (DEH) is extending the comment period on its proposed Negative Declaration and Initial Study for an eye gnat program and ordinance until 4:00 pm on June 20, 2012. To implement this extension DEH is re-noticing the proposed action. The proposed Negative Declaration and Initial Study are not being changed.

The remainder of this notification repeats information that was previously provided. DEH is proposing that the Board of Supervisors adopt a Negative Declaration in accordance with the California Environmental Quality Act for an ordinance amending Title 6 of the San Diego County Code of Regulatory Ordinances relating to Vector Control to establish a county-wide (incorporated cities and unincorporated area) Eye Gnat Program; ER#12-00-001. The San Diego County Code of Administrative Ordinances would also be amended. The proposed Eye Gnat Program and Ordinance would provide DEH authority to address eye gnat nuisances wherever they occur, and would implement a progressive strategy for intervention when commercial organic farms cause an eye gnat nuisance. Changes to the Ordinance as it was previously released for public review from January 31, 2012 to February 10, 2012 would still not authorize DEH to require the use of conventional pesticides on organic crops or fields or to restrict the crops that could be grown organically on a farm, except as a last resort. However, under this program DEH could only require the use of five conventional pesticides. DEH could not order that farms be closed, that farm size or intensity be reduced, or that physical barriers or fencing taller than 42 inches be used.

The proposed Negative Declaration and supporting Initial Study can be reviewed on the World Wide Web at http://www.sdcounty.ca.gov/deh/pests/eyegnats/eyegnats_home.html, at the Department of Environmental Health public counter located at 5570 Overland Avenue, Suite 102, San Diego, California 92123, the Assessors/Recorder/County Clerk office at 1600 Pacific Highway, Suite 103, San Diego, CA 92101, and all public library branches. Comments on the proposed Negative Declaration and Initial Study must be sent to the DEH address listed above or to eyegnat@sdcounty.ca.gov, attention to "Eye Gnat Ordinance and Program".

Comments on this proposed Negative Declaration and Initial Study must be received no later than **June 20, 2012** at 4:00 p.m. (a 20 day public review period). Comments received between May 24, 2012 and May 31, 2012 will be considered and be included in the record.

For those of you receiving this e-mail for the first time please scroll to the bottom of this page to manage your subscriber preferences; password and e-mail delivery addresses.

Regards,

Chris Conlan

Supervising Vector Ecologist

You are subscribed to Eye Gnats, Countywide for County of San Diego. This information has recently been updated, and is now available.

Update your subscriptions, modify your password or e-mail address, or stop subscriptions at any time on your Subscriber Preferences Page. You will need to use your e-mail address to log in. If you have questions or problems with the subscription service, please contact support@govdelivery.com.

This service is provided to you at no charge by County of San Diego.

This email was sent to sherimayer@gmail.com using GovDelivery, on behalf of: County of San Diego · 1600 Pacific Highway · San Diego, CA · 858-694-3900

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conti

June 16, 2012

To Whom This May Concern:

I am writing to express my concerns about the proposed Eye Gnat Program and Ordinance and the Negative Declaration.

Within the framework of the Ordinance, if the Director decides to force the use of pesticides, it will essentially shut the farm down as an organic farm cannot use conventional pesticides on their food. Conventional pesticides and organic farming are mutually exclusive. It does not matter if the pesticides are only used in "barrier crops" as the pesticides will leach into the water supply at the farm and contaminate the organic crops. Chemicals and pesticides are constantly being studied for their effects on cognitive development, brain chemistry, reproductive disorders, autism and cancer (to name a few) and every day scientists are finding more and more evidence to support the fact that these pesticides are responsible for causing such damage. I doubt anyone wants to shut Be Wise down as they are an integral and vital part of our community. They are a major food source for over 2800 families in San Diego county and supply a number of retail food chains, including Jimbo's and Whole Foods.

If the farm was unwilling to cooperate, I would understand the purpose behind developing an ordinance and giving the Director authority to influence the farm's methods. However, the farm is completely WILLING to implement a number of best practice measures without an ordinance in place and therefore, I see no reason to classify eye gnats as a vector and issue the ordinance as proposed. Especially without studying the entire ramifications of pesticides on the farm and surrounding environment. Be Wise Ranch operates in an Agricultural Preserve and uses methods of farming that protect the environment as well as enhance the surrounding community. Organic farming in itself is beneficial to all their neighbors as it improves water supply, maintains rich soil and provides healthy, nutritious food, thus keeping us all healthy. Organic farmers are granting us better health, a better environment, healthier water supplies and more delicious food by farming without using harsh chemicals and pesticides.

However, not everyone is concerned with the effects of pesticides. During a community meeting on February 2nd 2012, one resident asked if there were any pesticides that could eliminate the eye gnat. He was interested in spraying pesticides at his own home, instead of concentrating on the farm, as it is ultimately his home where the eye gnat chooses to live out their 15 day existence. Mr. Bethke replied that there are a number of pyrethrins and pyrethroids available at Home Depot that one could purchase. I feel this is a quick, accessible and affordable option for many residents, providing them with the relief they need while the farmer continues to work on controlling their breeding practices using their own organic methods. Many of the residents at this meeting seemed to be appreciative of learning this information. As these homes are not producing organic food, the use of pesticides on their property is a much more reasonable recommendation than requesting that our food sources be subject to these harsh and dangerous chemicals.

Everyone involved in this issue supports continuing research and funding for eradicating the eye gnat. My opinion is that we put the money and effort we are spending in developing this ordinance into further research for effective and organic control measures and abandon the proposed ordinance. It is also very necessary to study the effects that pesticides would have on the environment and community before implementing something as drastic as the proposed Ordinance. It is obvious the farmer is willing to work with the researcher and has taken the residents' concerns seriously or he would not be spending his profits on 2000+ traps and a silt fencing, not to mention all the time, energy and money attending these meetings and supporting this cause.

However, the residents should also make a matching effort. The woman sitting next to me at the meeting said she did not want to use the traps because they were "an eye sore" clearly indicating her preference for attractiveness over effectiveness. If the residents are serious about controlling and eventually ridding themselves of eye gnats, this has to be a partnership between the farmer and the community. It is obvious that the farmer is making a tremendous effort on his part and I'd like to see the complaining residents do the same.

It is a waste of taxpayer money and government resources to create an enforcement tool for someone willing to work with the community. Mr. Miller even himself admitted, "There is no solution at this point. No plan in place." This tells me we are not at a point of being able to produce a document that can be used as an effective tool. We need to focus on the research first, give the farmer an opportunity to pursue the methods he has put into place and see where we stand in two years time, reassessing the need for an ordinance at that time, if at all.

Regards,
Sheri Mayer

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continue

A.14

From: J McClure [mc006@pacbell.net]
Sent: Sunday, June 17, 2012 7:57 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Horn, Bill; carldemaio@sdcounty.ca.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program-Negative Declaration

Dear Mr. Miller,

I am concerned and confused by the county's actions on the eye gnat program. I don't believe that an ordinance is needed. Once in place there is always the risk that it will be implemented to satisfy understandably frustrated area residents. This is a situation where a calm, rational, step by step approach is needed to find a long term resolution that benefits all parties involved. An ordinance that is adopted without a careful review does not quality as a rational step by step approach.

The eye gnat problem is complex and requires a careful, multi pronged approach. I am sure area residents want a faster and simpler solution but that would not be in their best interests. My research on the eye gnat problem suggests that use of pesticides has not been effective in other communities in California and other methods such as those already started by Be Wise Ranch are the best way to control (not eliminate since that is not possible) the eye gnat population. Repeated use of pesticides would be needed to attempt to control the eye gnat population and is is likely that the eye gnats will develop resistance to the pesticides. We would be left with the negative effects and out of control levels of eye gnats. If there is any possibility that synthetic pesticides will be used under a county mandate, and it appears there is that possibility, then a full environmental review is needed and all citizens provided with the results of that review before the program and ordinance are adopted.

I am a customer of Be Wise Ranch. They provide our family with beautiful fruit and produce every week at a price that compares to buying non organic produce in major supermarkets. By buying from Be Wise we spend our dollars locally and taxes are paid to local government. Be Wise Ranch should be a source of pride for the city and county of San Diego and all efforts made to assure that the county and city programs give formal and careful consideration into the potential environmental effects of the ordinance.

I am also a nurse and an epidemiologist. We have a long history in this country of failing to consider the health and environmental effects of the use of synthetic chemicals to solve problems. We can learn from our past and move toward control of pests using methods that do not harm our health and environment but not if we act in haste to satisfy understandably upset fellow citizens. We can learn from the past and not enact regulations that can be misused despite the best intentions of those who wrote the regulations.

Thank you for taking the time to read my letter and include it in your considerations,

Jan McClure RN Ph.D.
Cardiff, Ca. 92007
760-942-2630

A.15

From: vance mcclure [bud.mcclure@pacbell.net]
Sent: Sunday, June 17, 2012 9:44 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupen/isor.com

Via E-mail: eyegnat@sdcounty.ca.gov

6/17/2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller,

I am a physical chemist with extensive experience in water and air pollution. I am writing to express my concern that a full environmental impact report is not being implemented before adopting the eye gnat ordinance. The impact of an ordinance that opens the possibility of mandatory use of synthetic pesticides in an area that has been farmed organically since the mid 1970's and an area of multiple protected species, requires careful and full consideration before any further action.

My research into this problem suggests that eye gnats are best controlled with a multiple non synthetic pesticide methods that decrease their population. I have contacted Be Wise Ranch and they are implementing these solutions. They report a decrease in the eye gnat population. What is the need in adding yet another ordinance, and indeed one that could be misused in the future to mandate the use of non-organic methods despite current assurances otherwise?

Too often the environmental effects of our actions have not been considered until the damage is done. We have learned this lesson but need to put it into practice.

Respectfully,

Vance E. McClure Ph.D.
2174 Cambridge Av
Cardiff CA 92007

Cc:
Supervisor Greg Cox - greg.cox@sdcounty.ca.gov
Supervisor Pam Slater-Price - pam.slater@sdcounty.ca.gov
Supervisor Ron Roberts - ron-roberts@sdcounty.ca.gov
Supervisor Dianne Jacob - dianne.jacob@sdcounty.ca.gov
Supervisor Bill Horn - bill.horn@sdcounty.ca.gov
Councilman Carl DeMaio - carldemaio@sandiego.gov
Steve Danon - Steve@stevedanon.com
Dave Roberts - campaign@daverobertsforsupen/isor.com

A.16

From: Mark Wallbridge [markw11@san.rr.com]
Sent: Friday, June 15, 2012 6:18 PM
To: LUEG, DEH-Eyegnat
Subject: request of full envirommental impact report on eye gnats ordinance and program

To Whom it may concern,

I oppose the negative declaration, and am requesting a full environmental report for the San Diego County Eye Gnat ordinance and program.

As a home owner in San Diego County that completely relies on Be Wise Organic ranch to provide my family with fresh, organic produce. I am appalled that county health officials would even consider hiring a firm to spray toxins on an organic farm,(or anything else for that matter) because of a fly which is a nuisance? How does this affect public health?(spraying toxins)

You are willing to strip the "organic" status from a farm that has been organic since the '70's. Please consider the other means of capturing these fly's, like implementing traps, promoting biodiversity, and removing monocultures.

Chemicals only puts a band-aid over the problem, and if chemicals are used over time the gnats will build up a tolerance for the pesticide.

Please think about the health of your family and friends, and how this program could affect them.

Sincerely, Mark Wallbridge
858-699-0226

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A.17

From: elsaturnino@gmail.com
Sent: Friday, June 15, 2012 6:41 PM
To: LUEG, DEH-Eyegnat
Subject: Oppose the Negative Declaration and Request a full Environmental Impact Report for the San Diego proposed Eye Gnat Ordinance and Program!

Saturnino Garcia
3355 Lebon Dr. Apt 302
San Diego, CA 92122-5203

June 15, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

As a member of the Be Wise Ranch community supported agriculture program, I am asking that you prepare a full Environment Impact Report for the proposed Eye Gnat Ordinance and Program.

Organic farming is better for our environment and our community. The negative declaration will cause drastic and unneeded damage to organic farmers in San Diego. Considering the rough economic times we face, we cannot afford to risk putting farmers out of business because of a few complaints from neighbors. There are many potential solutions to the eye gnat problems; more time is needed to thoroughly explore these solutions.

Sincerely,

Saturnino Garcia

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A.18

From: savolkhov@aol.com
Sent: Saturday, June 16, 2012 5:09 PM
To: LUEG, DEH-Eyegnat; sandra@bewiseranch.com

Re: "I was recently notified by the San Diego County Department Of Environmental Health along with The County Board of Supervisors that they are proposing to adopt a Negative Declaration and bypass a full environmental impact study. We believe that the Negative Declaration is inadequate and provides almost no analysis of important environmental impacts that would be caused should this Eye Gnat Program and Ordinance be placed in effect."

We too believe that given the importance of this issue, and the beneficial and positive role that Bewise Ranch plays in our county, and the impact of the proposed program and ordinance, in all fairness the full Environmental Impact study should be made. We have read the newspaper reports and think the complexity of the issue and the seemingly conflicting needs of the parties involved require as much in depth information as possible in order to determine an amicable settlement and solution that will work for all.

Sincerely yours, with thanks,

Stephanie Freeman and Yvonne Courtenaye Brown
7428 Cuvier Street
La Jolla CA 92037
(619)417-2969

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Keep calm and carry on.

A.19

From: Carleen HUNTER [vistahunters@sbcglobal.net]
Sent: Saturday, June 16, 2012 6:05 PM
To: LUEG, DEH-Eyegnat
Cc: steve@stevedanon.com; campaign@daverobertsforsupervisor.com; Slater, Pam; Jacob, Dianne; Horn, Bill; Cox, Greg; Roberts, Ron; carldemaio@sandiego.gov
Subject: eye gnat program and ordinance - negative declaration

Dear Mr. Miller,

I am appalled to find out that the County Board of Supervisors are willing to even consider bypassing an Environmental Impact Study of the eye gnat issue to allow spraying of pesticides on the organic farmland of the San Pasqual Valley.

We are members of the Be Wise CSA as are thousands of other families in San Diego County who depend on organic produce to feed our families. Tens of thousands more are able to purchase this produce in their local stores. Spraying pesticides will destroy organic farming in this area of San Diego County and will impact the entire food chain in that area as well as the water table.

If people are bothered by eye gnats there are other options. They can very inexpensively make and use traps on their property. The San Pasqual Valley is an agricultural preserve and spraying these poisons will not only render this farmland unusable for organic farming but will pollute the water table and affect everything in that area.

The reason that the Environmental Impact Study process exists is to prevent this kind of action from happening without a full understanding of the impact of such actions.

Our environment as a whole has been over-burdened by toxic substances and it is becoming more difficult for families to find sources of healthy foods for their families. Our food supply is vastly more important than the comfort of golfers.

Please use your influence to force the County Board of Supervisors to act responsibly not only as a steward to the environment in San Diego County but to the overall health of your constituents. The Negative Declaration is an irresponsible action.

Sincerely,
Carleen Hunter

A.20

From: Tiffany Altmann [ctiffgo@yahoo.com]
Sent: Saturday, June 16, 2012 6:39 PM
To: LUEG, DEH-Eyegnat
Subject: Be Wise Ranch

To:

Jack Miller
Department of Environmental Health
5570 Overland Ave, Suit 102
San Diego, CA 92123

Dear Mr. Miller,

This email serves as a request for a complete and thorough Environmental Impact/Aassessment Report regarding San Diego County's Eye Gnat Ordinance and Program. The use of chemicals in an environment must be fully investigated prior to use. As an individual paid by tax payer dollars, it is your obligation to the citizens of San Diego as a member of the health department to fully assess the impacts of chemicals PRIOR to use.

As a chemist and an organic produce supporter, I urge you to look into alternative methods to chemical pesticides, especially in an area that includes endangered species and organic food production. It would be irresponsible to do otherwise.

Thank you for your time and do diligence on this matter.

Kind Regards,

Tiffany
Member of Be Wise Ranch

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A.21

From: Mark Mealy [mealy52@yahoo.com]
Sent: Saturday, June 16, 2012 7:04 PM
To: LUEG, DEH-Eyegnat
Cc: Linda Mealy
Subject: Additional follow up

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

It is my understanding that the San Diego County Department Of Environment and The County Board of Supervisors are proposing to adopt a Negative Declaration and bypass a full environmental impact study. I believe that the Negative Declaration is inadequate and provides almost no analysis of important environmental impacts that would be caused should this Eye Gnat Program and Ordinance be placed in effect. I have supported Be Wise ranches mission of organic sustainable farming for many years to mitigate environmental impact on our local surroundings. I urge you to do a full environmental impact study so you will have all the facts to make a good decision.

The ordering of spraying chemical pesticides on organic farm land in the San Pasqual Valley or anywhere in San Diego County could have a negative impact on the organic farming and jobs in North County.

Kind regards,

Mark Mealy
760-822-1952
Encinitas, CA

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Mark Mealy
760-822-1952 Cell

A.22

From: Darlene Kanzler [dar.kanzler@gmail.com]
Sent: Saturday, June 16, 2012 7:37 PM
To: LUEG, DEH-Eyegnat
Subject: Be Wise Ranch allow full environmental impact report

Dear Mr. Miller,

I am writing to urge you to please allow the full environmental impact report to go forward for Be Wise Ranch. The future of organics in our county, state and country needs to be sustained as a matter of food security and environmental stewardship. The science has been proven to solve this issue in a way that does not violate the rules governing organic food.

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Thank you for your consideration,
Darlene Kanzler
1606 Debann Road
Cardiff by the Sea, CA
92007

A.23

From: Linda Weber [lindahomeemail@yahoo.com]
Sent: Saturday, June 16, 2012 7:38 PM
To: LUEG, DEH-Eyegnat
Cc: Ron-Roberts; lindahomeemail@yahoo.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration

To: Mr. Jack Miller
Dept. of Environmental Health
San Diego, CA

Dear Mr. Miller-

I am writing to request a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic produce grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status and an end to the healthy, pesticide-free produce the farm provides to me and my family. Be Wise Ranch was the first - and for many years the only - Community Supported Agriculture (CSA) program in the County. I have been a Be Wise member for 21 years. For all this time Be Wise has provided fresh fruits and vegetables at a pick-up site in my Point Loma neighborhood at a price lower than the cost of organic produce in grocery stores and markets.

The spraying of pesticides in the San Pasqual Valley will not only put an end to Be Wise Organic Produce, it will also impact the land, plants and animals of the area. Be Wise Ranch's organic farming methods are sustainable agriculture. Sustainable agriculture is good for the environment. The use of natural methods to grow crops and pests keeps pesticides out of our local food chain. It maintains the local ecosystem, which supports endangered species like the Arroyo Toad and California Gnatcatcher.

A full Environmental Impact Report is needed to examine the extensive impact of the spraying of pesticides in the San Pasqual Valley as opposed to natural methods of gnat control. As a County, we need to be finding ways to reduce the use of pesticides and herbicides, not increase them. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you.

Linda Weber
3429 Yonge St.
San Diego, CA, 92106
lindahomeemail@yahoo.com

A.24

From: Gerald Bischoff [cgbischoff@att.net]
Sent: Saturday, June 16, 2012 8:09 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; sandra@bewiseranch.com
Subject: Be Wise Ranch EIR

Dear Mr. Miller,

We are writing to request that a full EIR be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared appears to be inadequate in that it provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance. Allowing the proposed ordinance gives the County the authority to order the spraying of non organic and toxic pesticides on the organic crops grown at Be Wise Ranch. This would mean the end of organic farming for Be Wise Ranch.

My wife and I have been consuming produce from Be Wise for some 20 years. We feel that the organic produce has enriched our bodies, and given us the very best of nourishment. We cannot believe that the County would jeopardize the existence of Be Wise Ranch.

Again, if the Negative Declaration would allow the spraying non organic and toxic pesticides on the organic crops grown at Be Wise Ranch, then, we are strongly in favor of a full EIR.

To shut down a twenty some odd year business and deprive thousands of people, locally and across our country, of organic produce, would be the greatest abuse of authority. We believe a full Environmental Impact report will significantly make this fact paramount.

The impact of Be Wise Ranch having to cease organic farming because of a County ordinance to control eye gnats by the use of non organic and toxic pesticides would be tantamount to throwing the baby out with the bath water. Be Wise Ranch is vital to the thousands of people depending on its life giving organic produce. Anything less is just not acceptable.

Sincerely,
Patricia Bischoff, and
Gerald Bischoff, Retired County Employee
6349 Bunche Way
San Diego, CA
92122

A.25

From: bgilwee@cox.net
Sent: Saturday, June 16, 2012 8:40 PM
To: LUEG, DEH-Eyegnat
Subject: Negative Declaration

Answer one question. How long will you wait, after you have been told you or a family member has cancer, will you stop eating pesticides?

A Negative Declaration is wrong, and everyone involved knows it.

Brian Gilwee

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A.26

From: GREG CURRAN [gregcurran@sbcglobal.net]
Sent: Friday, June 01, 2012 6:21 PM
To: LUEG, DEH-Eyegnat
Cc: Bill Pape
Subject: Ordinance Amendment - Eye Gnat Program

Please note that I am a resident of Jacumba, CA and am opposed to the proposed amendment 'Title 6 relating to vector control" It is to vague as to what constitutes "Last Resort". I am all for combating/addressing the Eye Gnat problem using natural and other methods of control but having an amendment that sounds like your leaving it wide open for interpretation of what last resort is. I'm opposed to using any of the 5 toxic substances mentioned as "conventional pesticides". Organic farming should be just that, no harmful chemicals. We really do not know what the long term side effects are and I would like to see our community be as green & clean as possible.

Thank you for your consideration.

Greg A. Curran

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A.27

From: Lock, Patrice [plock@ucsd.edu]
Sent: Friday, May 25, 2012 8:26 AM
To: LUEG, DEH-Eyegnat
Subject: Please don't RUIN Organic Farming in San Diego County

Gentlemen,

OK, honestly, what part of "organic" farming do you not understand? How can this: **However, under this program DEH could only require the use of five conventional pesticides** possibly result in an ORGANIC farm?! I am strongly opposed to this measure as presented. I cannot believe you really want to endanger organic farming in San Diego in this manner!

Please, at very least, give the traps and other measures a chance to work (remember this takes TIME and will require the courage on your part to preach patience!!!!) before moving to anything this drastic.

Patrice M Lock
Office of Research Affairs – Administration
858-822-3439

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A.28

From: Kai [kai@wigglesfish.com]
Sent: Saturday, June 16, 2012 7:18 PM
To: LUEG, DEH-Eyegnat
Subject: eye gnat

From: John McDonald [paulamcd@cox.net]
Sent: Saturday, June 16, 2012 9:15 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandigo.gov
Subject: Eye Gnat Ordinance and Program - Negative

I can remember when organic produce was ugly, worm-eaten, and unappetizing. We were told that this is what we get when farmers don't use pesticides. It took a few years, but we now get beautiful, healthy, tasty veggies and fruit, thanks to the ingenuity of our organic farmers. They are problem solvers. I beg you to give them the chance to solve the eye gnat problem without poisoning the environment and living creatures. Organic farmers are among the vanguard trying to protect our environment, they need support, not opposition. I hope you will consider the long term health and welfare of the people of San Diego County when making this critical decision, not just vote for a quick fix. Sincerely,
Paula McDonald

A.30

From: Cindy Tozer [cindy.tozer@yahoo.com]
Sent: Saturday, June 16, 2012 9:22 PM
To: LUEG, DEH-Eyegnat
Subject: No Pesticides Please

PESTICIDES! That's a big step backwards. Please, no pesticides.

I'm trying to eat a healthy diet of vegetables/fruits that are free of these potentially carcinogenic chemicals.

I love my organic box of LOCAL produce every week and want to support increased growth in the organic agricultural business in San Diego County.

Thank you for consideration of this matter.

Cynthia Tozer

10912 Evening Creek Dr. 92128

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A.31

From: Clayton Haven [claytonhaven@cox.net]
Sent: Saturday, June 16, 2012 9:48 PM
To: LUEG, DEH-Eyegnat
Subject: eye gnats

How in the world can we possibly hope for a saner world when we seek to sanitize our properly rural space. Is there a used car dealer out there, or perhaps a banker who chooses to alter the countryside to fit his/her city habits? Those of us who understand the need for healthy food must take a back seat to cancerous sprawl. A pox, or at least an eye gnat to their house. Clayton Haven

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A.32

From: Susan Matthews [smatthews23@gmail.com]
Sent: Saturday, June 16, 2012 10:33 PM
To: LUEG, DEH-Eyegnat; Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Be Wise Ranch and the eye gnat ordinance

I am writing to request that you support Be Wise Ranch and allow time for a full environmental impact report to be completed. I am extremely concerned about pesticides being sprayed on our food. Especially the food I feed my young children. And I am concerned about the effects on our eco-system. We need to focus on all working together on a pesticide-free alternative for Be Wise Ranch.

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Thank you in advance for your support!

- Susan Matthews

San Diego resident

From: Sarah Wong [sarah.wong@mail.com]
Sent: Sunday, June 17, 2012 1:00 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Jacob, Dianne; Roberts, Ron; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance - Negative Declaration

Dear Mr. Jack Miller,

I am writing again to ask you to reconsider this action proposed under the negative declaration on the Eye Gnat issue. There must be a negative impact on the environment under the proposed actions to utilize chemical spray to control the gnat. Has your department considered the ill-effects that spraying will cause to the environment, the habitat and the health of our people in the area? Has there been any study performed to fully understand the repercussions of the declaration?

In my search to see the effectiveness of controlling the eye gnat, spraying is only a temporary relief and the insect life cycle is such that they will repopulate. So fighting it with poison will in turn only cause us to poison other plants and animals in the area. Additionally, as we have seen with pesticides in general, they are known to cause health problems. This is the reason that in the past decade, I have slowly incorporated and switched my family's diet to eating foods sourced primarily from organic farms. Our county is privileged to have such farms in the area. These farms have done an excellent job in providing my family with fresh fruits and vegetables and committed to keeping our community healthy.

Please allow our family to have the option to obtain organic food locally. Our family's commitment is to try to eat as much local and organic food as possible so as to reduce environmental impact of transportation. Additionally, we benefit from eating fresher produce that is more nutritious. I have a four year old boy who has always known that we pick up grocery boxes, not just from stores, but also from a farm drop off point. Because of this extra special trip, he enjoys a variety of fruits and vegetables, much more than any other four year I have known. He is dairy intolerant so I am not able to give him milk and have been successfully replacing his calcium needs by eating more green vegetables. I have a daughter who is six months old. She is being introduced to solid foods and having an organic farm provides her the opportunity to develop young brain with food free of pesticide and chemical fertilizers. There are parents in this community who want to raise children who are not ADHD, or grow up to be adults with diabetes and other life threatening diseases.

I am pleading with you, this issue is of utmost importance to me and my family. Having these farms also allows local grocery stores to provide organic produce at a much more reasonable price. I know you will find that a growing number of San Diegans who are interested in keeping our organic farms around. Your policy will force these farms to loose their organic status. In addition to the organic farm issue, I am also very concerned about the delicate habitat in the area that will be affected. Please stop the spraying. Find an alternative solution. I know the farms are working on alternative solutions. Allow them time to work it through. They are committed to making this work. Please put your resources to alternative solutions.

Regards,

Sarah Wong.

A.34

From: Bonnie Wren [socalbonnie@gmail.com]
Sent: Sunday, June 17, 2012 6:03 AM
To: LUEG, DEH-Eyegnat
Subject: Attn: Jack Miller - Re: Eye Gnat Ordinance & Program

Dear Mr. Miller:

I am writing regarding the Proposed Eye Gnat Ordinance and BeWise Ranch. I respectfully request that the Department of Environmental Health prepare a full Environmental Impact Report before it tries to destroy San Diego County's oldest and best organic farm.

It is extremely short-sighted to force the application of pesticides before exhausting all other alternatives in resolving the eye gnat problem. Such a move will seriously damage a locally-owned, San Diego County business that not only provides welcome sales tax revenue, but which has responded to the county's voracious demand for locally-grown food.

Getting an organic certification is so costly and time-consuming that many smaller farms with which I do business are giving up the certification process. The villains are typically big food corporations, and yet San Diego County seems determined to join the ranks of those "Big Food" lobbyists.

Think of the shameful and narrow-minded legacy your administration will leave: that of a persistent determination to destroy sources of wholesome produce when the entire country is turning to small farms to improve our food quality.

Is San Diego trying to push all organic farming operations out of this county? How can small, non corporate farms like BeWise survive while we try to poison them?

I ask you to please consider the Negative Declaration as inadequate and work instead to find a non-pesticide alternative.

Sincerely,

Bonnie Wren
3342 Camino Coronado
Carlsbad, CA 92009

A.35

From: Stephanie Cauchon [scauchoned@gmail.com]
Sent: Sunday, June 17, 2012 6:32 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Roberts, Ron; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: No on proposed eye gnat ordinance

I request that the county not implement the proposed Eye Gnat Ordinance and Program, and conduct a full EIR. The notice of the ordinance that I received from the county at first review appeared reasonable, but on closer inspection I found that it would still open the door to spraying of pesticides on organic farms. At this point this is not an acceptable alternative, as it threatens the viability of organic farming in San Diego County.

I have been a customer of Be Wise Ranch for 20 years, spurred by my concern for the environment and sustainable farming methods. Be Wise has been a pioneer that has fostered the growth of organic farming and CSA's in San Diego in recent years.

My family owns land in Campo. My daughter is considering ranching organically on the property. Please support this important economic sector and direct county staff to work with Be Wise and other farms to find ways to control the gnats that are in harmony with sustainable organic farming practices.

--
Stephanie Cauchon

phone 619.884.9265

A.36

From: Jayne Kuhlman [jayne.wow@gmail.com]
Sent: Sunday, June 17, 2012 7:26 AM
To: LUEG, DEH-Eyegnat
Subject: support for Be Wise Ranch

This letter is written to support Be Wise Ranch and organic farming.

Please undertake a full-blown Environmental Impact Report before you start telling Be Wise how to run its business. A small group of newcomers to San Pascual Valley should not dictate county farm policy.

I received a copy of the letter showing the intent to issue a "Negative Declaration". I really must comment on the obtuse language in this information letter. I am a teacher and I could not understand this letter. My daughter (MA in Environmental Science) could not understand it either. Nor did her PhD husband. Plain English please.

Jayne Kuhlman
4435 Osprey
San Diego, CA 92107

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A.3/

From: Joshua Goldman [jjgold1@gmail.com]
Sent: Sunday, June 17, 2012 8:57 AM
To: LUEG, DEH-Eyegnat
Subject: Organics

Please ensure us organic consumers of local produce and strong CSA advocates are considered in the upcoming rule making.

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From: Susan Engel [drsuzq@mac.com]
Sent: Sunday, June 17, 2012 10:04 AM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnats

I request a full environmental impact report be prepared for the County's proposed Eye Gnat Ordinance and Program.

I am a Be Wise Ranch CSA member.

Signed,

Susan Heiman Engel

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From: Judy Botello [jbotello1@gmail.com]
Sent: Sunday, June 17, 2012 11:57 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sdcounty.ca.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: eye gnat ordinance and program, negative declaration

June 17, 2012

Jack Miller
Department of Environmental Health
5570 Overland Ave. Suite 102
San Diego, CA 92123

Dear Mr. Miller:

I am writing because of my concern regarding the county's proposed Eye Gnat Ordinance and Program. Let me state that I am not only a happy member of Be Wise Ranch's Community Supported Agriculture program (CSA), but I am also a resident of Sonata in Escondido, one of the hardest-hit communities by the eye gnat nuisance. Therefore, I have a special interest in a balanced approach to meeting this challenge—one that will result in a win-win situation for both sides.

In fact, it is unfortunate that we even have to speak of "sides" in this matter. Be Wise's farmer, Bill Brammer, has proven himself to be a good neighbor, taking very seriously the concerns of Sonata and other affected communities. And most of my Sonata neighbors have proven themselves to hold reasonable attitudes regarding solutions to the problem that are not so extreme as to destroy one of the jewels of San Diego County—the beautiful San Pasqual Valley.

Under the guidance of the county's entomologist, Mr. Brammer has already installed numerous eye gnat traps around his farm and on the properties of some of the local residents. These traps have, so far, been very effective; we have noticed a marked decrease in the eye gnat population compared to recent years. Like most natural processes, the control of eye gnats will take time to be fully effective.

The Department of Environmental Health is charged with the health of our environment, obviously. It's hard to see how opening the door to the spraying of inorganic pesticides could possibly be a move that would improve the health of our environment! Far more is at stake than the future of Be Wise Ranch, although that alone is worth fighting to save. But the San Pasqual Valley is home to numerous birds, mammals, and reptiles that make our county such a special place to live. Losing one of our most successful organic farms would be a tragedy; losing or depleting our local fauna would be a disaster.

Please consider a balanced approach to this eye gnat issue. There is still time for a win-win solution; in fact, it is already in process. Let us learn from past mistakes, and avoid the unintended consequences of extreme measures!

Thanks for your attention.

Sincerely,

From: Sheila Murdock [the_murdocks2004@yahoo.com]
Sent: Sunday, June 17, 2012 12:25 PM
To: LUEG, DEH-Eyegnat
Cc: Jacob, Dianne; Horn, Bill; Steve@stevedanon.com; carldemaio@sandiego.gov; campaign@daverobertsforsupervisor.com; Cox, Greg; Slater, Pam; Roberts, Ron
Subject: SERIOUS CONCERN about the Eye Gnat Ordinance and Program

June 17, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123
Email: eyegnat@sdcounty.ca.gov

Re: Eye Gnat Ordinance and Program

Dear Mr. Miller,

The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine, Cyfluthrin) on the organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status, and end to the healthy, fresh produce the farm provides me and my family, and a loss of productive organic farmland.

Wouldn't this be counter-intuitive to the County's **Public Health Services' mission** of: "Protect and enhance the health of the community by promoting health, preventing disease, and communicating public health information." as the ordinance and program seriously hinders the healthful impact of Be Wise Ranch's organic produce on voting residents and their families? I am *emphatically* requesting that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area. Your environmental document gives no analysis to these impacts. I am concerned about the health of my family and the local ecosystem, and I really want to know what these impacts will be.

I am currently a dedicated consumer of the Be Wise Ranch's produce through Jimbo's...Naturally grocery stores, which provides fresh vegetables to me. I drive out of my way, bypassing large grocery-chain stores, to go to my local Jimbo's for Be Wise's offerings. The ordinance will impact Jimbo's business as well, and I fear you will start an unforeseen, negative chain-reaction among other local businesses., too.

Would the County please wait to see the results of what Be Wise Ranch is doing *before* enacting
ore regulations that hurt our local businesses?

Please consider the significant impacts to the health of my family, our families, and San Diego
businesses that will be created by your ordinance. Please do the right thing and work with Be Wise
Ranch on a pesticide-free alternative to this ordinance.

Thank you,

Sheila Murdock
Resident, Parent, Community Activist
& a registered San Diego County P&R Volunteer

Cc:

Supervisor Greg Cox – greg.cox@sdcounty.ca.gov
Supervisor Pam Slater-Price - pam.slater@sdcounty.ca.gov
Supervisor Ron Roberts – ron.roberts@sdcounty.ca.gov
Supervisor Dianne Jacob – Dianne.jacob@sdcounty.ca.gov
Supervisor Bill Horn – bill.horn@sdcounty.ca.gov
Councilman Carl DeMaio – carldemaio@sandiego.gov
Steve Danon – Steve@stevedanon.com
ave Roberts – campaign@daverobertsforsupervisor.com

Sheila M.

From: Diana Robinson [diana@RFG-inc.net]
Sent: Sunday, June 17, 2012 1:09 PM
To: LUEG, DEH-Eyegnat
Subject: Gnat spray

Do Not spray pesticides on organic farm!!!!

Sent from my iPhone

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A.42

From: Laura Glusha [artsonstone@yahoo.com]
Sent: Sunday, June 17, 2012 1:36 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller,

When I first read of the negative ordinance regarding the eye gnat problem at Be Wise Ranch in Escondido, I was infuriated. However, I did not hear an outcry from organic farming supporters, so I thought I possibly misunderstood the negative ordinance.

Now I know I was correct in my original anger.

Organic food to me is life itself. I am now 90 years old and a productive member of our society because of organic food. I have had major health problems my entire life and only when I was able, about 40 years ago, to go on an entirely organic diet, did my health finally return. 1

I buy the produce of Be Wise Ranch at Jimbo's in Escondido, and have done so since the opening of the store.

The idea that one person in government, **The Director of Vector Control, because of a neighbor's complaints**, can order poisonous sprays on a wonderfully run organic farm which would take away their **organic status**, is beyond belief. Poisonous sprays will also endanger the health of endangered and threatened species in the San Pasqual Valley.

As a taxpayer and a very involved citizen of this county I ask, why is this ordinance being rushed without a **full Environmental Impact report**? 2

The organic farmers are participating in legitimate, scientific research to mitigate the problem and are assembling the necessary traps to implement proven measures to control eye gnat populations. Eye gnats at the golf course **are way down from a couple of years ago** so it seems like what Be Wise is doing is working. 3

I ask you to please reconsider the negative declaration and instead have a **full Environmental Impact Report**. Do the right thing and work with Be Wise Ranch on a pesticide free alternative to the ordinance.

Thank you.

Laura Glusha
6 Larry Lane
Escondido, CA92025
760 480 0844

A.43

From: ghall92078@yahoo.com
Sent: Sunday, June 17, 2012 1:46 PM
To: LUEG, DEH-Eyegnat
Subject: The food my family eats

Gregory Hall
1538 Brighton Glen Rd
San Marcos, CA 92078-5494

June 17, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

Every week, I buy as much local produce from San Diego County organic farms as I can. Eating local organic produce is important to me for health reasons, and important to me because I want my dollars to support local businesses. Every Saturday I shop at the Vista farmer's market in the morning, and Jimbo's grocery store in the afternoon.

I count Be Wise ranch to be my leading source of local, organic, healthy produce. My family eats lots of strawberries, carrots, squashes, greens, etc. from Be Wise.

So I am writing to request that a full Environmental Impact Report be prepared for San Diego County's proposed Eye Gnat Ordinance and Program.

The Negative Declaration that was prepared is simply inadequate. It provides almost no analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance is likely to result in the spraying of pesticides on the organic crops grown at the Be Wise ranch and other organic farms. This will mean the loss of organic status for these farms, an end to the local, healthy, fresh produce the farms provide, and a loss of productive organic farmland.

I will continue to buy organic -- but that means my dollars will be sent outside San Diego County.

Please do the right thing for your constituents and for our local agricultural businesses and economy. Please work with organic farmers on a pesticide-free alternative to this ordinance.

Sincerely,

A.44

From: Jeff Skeith [jskeith1@san.rr.com]
Sent: Sunday, June 17, 2012 3:09 PM
To: LUEG, DEH-Eyegnat; Cox, Greg; Slater, Pam; Roberts, Ron; Jacob, Dianne; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Re: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller,

Albert Einstein stated, "condemnation without investigation is the height of ignorance." I'm not trying to insult anyone here, rather, I'm trying to put into focus that taking action without proper investigation is how bad decisions come about. Einstein was a pretty bright guy who understood this principle, but the principle stands on its own even without Einstein's quote.

Our society is saturated with pesticide. It is becoming saturated with pesticide resistant weeds. Sustainable, non toxic farms keep the community healthy and reduce health care costs. If Be Wise Ranch is causing an additional problem that never occurred in the past, then Be Wise should be given adequate opportunity to minimize that problem. Some level of gnats are going to exist in rural areas, though, so we need some sense of reason applied here and my hope is that this comes from the elected decision makers without any rash judgments.

The convenience of golfers who demand a low gnat or gnat free rural environment need to be balanced against the desires of people to feed their children food without pesticide in it. There is a reason that rates of chronic illness are skyrocketing, and I'd love to see all the research you have that a steady diet of pesticides plays no role at all.

As I understand it, the gnat problem is getting better over time. Why not let that process play out over more time?

While you are at it, please do what you can to stop putting toxic waste in the water since the EPA opposes it due to multiple studies that show it harms the brain and body over time and they question whether there are any scientifically proven benefits at all. The CDC admits there is no science supporting significant benefits for children 0-6 months, but there are health detriments.

WHY EPA HEADQUARTERS UNION OF SCIENTISTS OPPOSES FLUORIDATION

<http://www.nteu280.org/Issues/Fluoride/NTEU280-Fluoride.htm>

CDC response on fluoride and infants 5/12

<http://dougcragoe.webs.com/apps/documents/>

<http://dougcragoe.webs.com/documents/CDC%20response%20on%20infants-fluorosis%205-12.pdf>

"The Institute of Medicine *IOM) has concluded that fluoride intake from human milk (0.01 mg/d) is adequate for infants aged 0-6 months because

risk of tooth decay DOES NOT APPEAR TO BE SIGNIFICANTLY DECREASE."
~CDC Response to Barbara Boxer, May 15, 2012

That's the CDC's response to "The Honorable Barbara Boxer." The CDC refused to respond when a citizen asked the question directly - apparently, citizens aren't worth the effort anymore.

Why would people in positions of power use small children as toxic waste (typically low dose toxic waster, but the dosage is not controlled) filters when the Institute of Medicine can't cite a single study showing a significant benefit to tooth decay prevention and the EPA scientists, the very people who are supposed to make these kinds of recommendations, oppose it?

I know you can find some claimed "expert" to hide behind in order to continue using vulnerable children as toxic waste filters if you so choose, but what they apparently can't do is provide the IOM data that shows an increase in tooth decay protection for children 0-6 months.

Thank you for your consideration on both issues at hand. Any help you can provide to help people detoxify from pesticides and industrial waste products is greatly appreciated.

Kind regards,

Jeff Skeith

2
continued

A.45

From: Jim Conwell [jconwell@san.rr.com]
Sent: Sunday, June 17, 2012 4:44 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov;
steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance

JAMES L. CONWELL
1027 F Avenue
Coronado, CA 92118

June 17, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Mr. Miller:

I am writing concerning the Eye Gnat Ordinance and Program. I understand that a negative declaration was prepared and I am concerned that it provides little meaningful analysis of important environmental impacts that will be caused by the ordinance.

I have been a member of the Be Wise Ranch Community Supported Agriculture program for a number of years and I enjoy the variety of fresh healthful produce that I receive from them. My son is also an organic farmer in the Central Valley, so I understand the myriad of governmental agencies and regulations that he must deal with on a daily basis in running his small farm. I am very concerned that the proposed ordinance will give the County the authority to order the spraying of various pesticides, including Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin at Be Wise Ranch. If such chemicals are used there, it will mean the end of their status as an organic farm as well as a loss to me and my family of healthful fruits and vegetables.

Another issue about the proposed ordinance that concerns me is that while it gives the County the power to order spraying of non-organic chemicals, it does not address the impact to the plants and animals in the San Pasqual Valley. The Valley is a San Diego open space park and agricultural preserve, supporting various endangered and threatened species, including the Arroyo Toad, the Least Bell's Vireo, and the California Gnatcatcher. I believe that the Be Wise Ranch's use of organic farming methods is in harmony with protecting these species. Your document does not address how these species will be impacted or what the impact would be on farming in the area should the use of these pesticides be permitted.

I implore you to reconsider the negative declaration and instead require that a full Environmental Impact Report be prepared. By doing so, the full impact of the ordinance can be documented and all inputs can be taken into account. I believe that a solution can be found that will satisfy the needs of all concerned, so please do not rush the process and consider ordering the full Environmental Impact Report.

Sincerely,

James L. Conwell

A.46

From: Craig Ditzler [ditzlerchiro@earthlink.net]
Sent: Sunday, June 17, 2012 4:44 PM
To: LUEG, DEH-Eyegnat

Please do not spray pesticides on our food.
Craig A. Ditzler D.C.

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A.47

From: Nancy Bensimon [sewcrazynancy@me.com]
Sent: Sunday, June 17, 2012 6:30 PM
To: LUEG, DEH-Eyegnat
Subject: spraying organic farms

Dear County Supervisors, PLEASE do not spray our organic farms like Be Wise Ranch. This is the 3rd time I have had to write to you folks as you reconsider this issue. THE ISSUE remains the same, those of us who purchase organic produce from Be Wise Ranch do not want pesticides sprayed anywhere near the food we eat! The issue is the same over and over, so why do you keep reconsidering it? Please do not try to solve the problem of the gnat by killing our food source! I repeat.....organic farms like Be Wise are critically important in supplying top quality produce to private customers, at Jimbo's and Whole Foods. Thanks for listening. Nancy Bensimon

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A.48

From: Brina-Rae Schuchman [womenact@cox.net]
Sent: Sunday, June 17, 2012 10:21 PM
To: LUEG, DEH-Eyegnat
Cc: womenact@cox.net
Subject: Eyegnats solution

To all who are searching for solutions to the EyeGnat problem in San Diego ---\

Please help solve the Eyegnat problem without killing organic farming in San Diego .

That is so important.

Please try every way to work through this, so the Eyegnats are more controlled and the farms are protected.

We need clean land so we can have healthy food.

Thank you,
Brina-Rae Schuchman and family
San Diego County citizen and
Be Wise Ranch food buyer.

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A.49

From: CYNTHIA MALEY [cmaley@cox.net]
Sent: Sunday, June 17, 2012 10:24 PM
To: LUEG, DEH-Eyegnat
Subject: RE: Eye Gnat Ordinance and Program

Dear Mr. Miller:

I am writing to request a full Environmental Impact report be prepared for the county's proposed Eye Gnat Ordinance Program. The Negative Declaration did not provide meaningful analysis of the impacts that will be caused by the ordinance.

I do not the county to order the spraying of pesticides on the organic crops I depend on from the Be Wise Ranch. I am a current member of the the Be Wise Ranch CSA which provides fresh produce to me.

I am concerned that the spraying of pesticides will impact plants and animals in the San Pasqual Valley. Your document looks at a lot of County policies, but the impacts of the Be Wise Ranch and the the Valley are in the city of San Diego. I do not believe that the county has give the Be Wise ranch the opportunity to use natural methods to control the pests. Spraying pesticides would allow pesticides to enter into my food chain.

Why is the county rushing this ordinance? Eye gnat populations at the golf course are down. Why won't the county give the Be Wise Ranch more time to use a pesticide-free alternative to this ordinance.

Thank you,
Cynthia Maley

From: Megan Werland [meganwerland@cox.net]
Sent: Monday, June 18, 2012 6:10 AM
To: LUEG, DEH-Eyegnat
Subject: Be Wise Ranch Environmental Impact Report

To Whom it May Concern,

I am writing to request that a full Environmental Impact Report be prepared for the County's Eye Gnat Ordinance and Program. The Negative Declaration that is being proposed is inadequate and does not provide proper analysis of the entire situation.

We are fortunate in San Diego to have organic farmers operating in our region, so we should do all that we can to properly assess what is going on. Of course, the residents deserve to have their voices heard, but spraying chemicals on nearby crops won't help the crops and it won't help the residents. You may not know much about organic farming, but a huge component of it involves sustainability of the environment, which will benefit all residents of San Diego. This involves eliminating harmful toxic chemicals from our food, soil, air, and water supply. Please do not allow this to become a political issue. Make the right decision and enact a full Environmental Impact Report.

Thank you for your time,
Megan and James Werland
2835 Via Viejas Oeste
Alpine, CA 91901

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A.51

From: Lock, Patrice [plock@ucsd.edu]
Sent: Monday, June 18, 2012 7:46 AM
To: LUEG, DEH-Eyegnat
Subject: Full Environment Impact Study, please! - NO pesticides on organic farms!

I do not approve of bypassing the full environmental impact phase in order to force organic farms to spray "just a few" pesticides to prevent eye gnats. ANY pesticide voids an organic farm. You cannot possibly want the negative publicity this will bring... AT VERY LEAST, go through the entire environmental impact study process. Do not be railroaded into ruining organic farming in a large part of San Diego County for the foreseeable future without this important step!

Patrice M Lock
858-822-3439

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From: Cynthia Millsaps [miltoki@gmail.com]
Sent: Monday, June 18, 2012 8:34 AM
To: DEH, Vector; LUEG, DEH-Eyegnat
Subject: Pubic Comment on Eye Gnat Ordinance and Program--Negative Declaration
Attachments: EyeGnatJune182012.pdf

Attached are my comments regarding my concern of the adopting the Negative Delcaration regarding eye gnats without a full environmental impact review. Thank you, Cynthia Lynne Millsaps

--

sent from the miltoki i-Device!

Cynthia Lynne Millsaps

9468 Palomino Ridge Dr. Lakeside, CA 92040
miltoki@gmail.com

Via e-mail: eyegnat@sdcounty.ca.gov

Jack Miller
Department of Environmental Health
5570 Overland Ave., Ste 102
San Diego, CA 92123

Re: Public Comment on Proposed Eye Gnat Program and Negative Declaration

Dear Chairman Roberts and Honorable Supervisors:

I have been concerned with both the problem and solution(s) to the county eye gnat problems for some time. I attended the Board meeting on November 9, 2011 and have read the report issued by the Department of Environmental Health as well as the proposed ordinance and Negative Declaration. I truly appreciate that this is a difficult issue and there seems to be very little easily accessible "common ground" between the competing interests.

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that has been prepared is woefully inadequate and provides virtually no meaningful analysis of important environmental impacts that will be caused by the ordinance. The proposed ordinance gives the County the authority to order the spraying of pesticides, including Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin, on organic crops. This will mean an end to the organic status of Be Wise Ranch and an end to the healthy, farm-fresh produce the farm has provided for me and my family for more than twenty years. Additionally, this means a loss of productive, organic farmland.

I live in an area of San Diego County which has grown increasingly urban in the thirty plus years that I have lived there....clearly there are competing needs between agricultural interests and residential interests. I have been a long-time customer and supporter of Be-Wise Ranch. I am very concerned that any ordinance that is adopted take into careful consideration the needs of agriculture. Undoubtedly, this County is rapidly pushing out agricultural production in favor of urbanization, and any solution to the eye gnat problem needs to be shared by both the residents as well as the farming interests. Organic farming is not only a valuable economic resource in this community, but it provides residents with local, healthy produce, and, due to development, land that is suitable for organic farming is becoming less and less available.

I am especially concerned that the spraying of pesticides will impact the plants and animals in the San Pasqual Valley. The Valley is an open-space park and agricultural preserve and supports endangered and threatened species like the Least Bell's Vireo, California Gnatcatcher and Arroyo Toad. The Be Wise Ranch's use of organic farming methods is in harmony with the protection of these species and the preservation of open space. The implementation of this ordinance without proper environmental review does not take into account the serious impacts on the health of humans and the local ecosystem. No consideration has been given to the fact that the population of eye

gnats at the golf course is substantially decreased, thus indicating that the measures taken by Be Wise Ranch are successful in reducing eye gnats.

Please give consideration to the significant impacts to the environment, the health of families, and the impact on local, organic farming businesses. Thank you for your attention to this matter.

Very truly yours,

s/ Cynthia Lynne Millsaps
Cynthia Lynne Millsaps

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contin

From: Julie Sanders [jsanders107@gmail.com]
Sent: Monday, June 18, 2012 8:56 AM
To: LUEG, DEH-Eyegnat
Subject: eye gnat ordinance and program

Hello,

I am writing to request a full environmental impact report be prepared for the county's proposed eye gnat ordinance program. I feel a negative declaration is inadequate for properly reporting the full environmental impacts of the ordinance. The impact I am most concerned with is forcing an established organic farm - one that is very important to my community, Be Wise Ranch - to spray pesticides on their crops. This would destroy the farm, since their organic certification would be forfeited. In my mind, you might as well just take a blow torch to it. I'd rather eat ashes than poison. I strongly urge you to reconsider any stance that will put the health of the environment and the San Pasqual Valley community in jeopardy by short-changing the issue with a negative declaration. Do the environment impact! As much information should be gathered and considered before such a huge decision is made that will forever impact the lives of so many people.

Thank you.
Julie Sanders

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A.54

From: Renata Pawluk [pawluk.renata@gmail.com]
Sent: Monday, June 18, 2012 8:57 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller:

I am extremely concerned about the impact of the proposed Eye Gnat Ordinance and Program. A full Environmental Impact Report has not been prepared and I truly believe it should be done before a decision is made.

This ordinance gives the County the authority to order the spraying of pesticides on the organic crops of Be Wise Ranch, the place I get most of my vegetables and fruits from. I believe it is extremely unfair for the people who knowingly choose to move next door to a farm should not have the power to then change the farm's culture. This will ruin their crops in the eyes of their customers and in turn they will lose their business. I, like many of my friends who buy from them, will no longer be interested in their produce if it is not organic and neither will all of the markets they sell to (ie: People's Market in Ocean Beach).

The spraying of pesticides will also have an impact on the plants and animals in the San Pasqual Valley. Be Wise Ranch's methods are in harmony with the protection of these species because of its organic farming ways. I am concerned about the health of my family and the local ecosystem. Eye gnats are significantly down this year compared to years before and I don't understand the rush to pass this ordinance and ruin a family's farm and way of life.

Please consider the significant impact to the health of all of the families who depend on Be Wise Ranch and the impact on the environment that will be created by your ordinance. Please do the right this and work with Be Wise Ranch on a pesticide free alternative to this ordinance.

Thank you,

Renata Pawluk

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From: Renata Campos [renatacp@yahoo.com]
Sent: Monday, June 18, 2012 8:59 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program – Negative Declaration

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller:

I am extremely concerned about the impact of the proposed Eye Gnat Ordinance and Program. A full Environmental Impact Report has not been prepared and I truly believe it should be done before a decision is made. 4

This ordinance gives the County the authority to order the spraying of pesticides on the organic crops of Be Wise Ranch, the place I get most of my vegetables and fruits from. I believe it is extremely unfair for the people who knowingly choose to move next door to a farm should not have the power to then change the farm's culture. This will ruin their crops in the eyes of their customers and in turn they will lose their business. I, like many of my friends who buy from them, will no longer be interested in their produce if it is not organic and neither will all of the markets they sell to (ie: People's Market in Ocean Beach). 5

The spraying of pesticides will also have an impact on the plants and animals in the San Pasqual Valley. Be Wise Ranch's methods are in harmony with the protection of these species because of its organic farming ways. I am concerned about the health of my family and the local ecosystem. Eye gnats are significantly down this year compared to years before and I don't understand the rush to pass this ordinance and ruin a family's farm and way of life. 6

Please consider the significant impact to the health of all of the families who depend on Be Wise Ranch and the impact on the environment that will be created by your ordinance. Please do the right this and work with Be Wise Ranch on a pesticide free alternative to this ordinance.

Thank you,

Renata Pawluk

A.55

From: Ariane Jansma [ajansma@scripps.edu]
Sent: Monday, June 18, 2012 9:14 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller,

I am writing to request that a full EIR be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

My family and I are members of the Be Wise Ranch CSA which provides fresh vegetables to me at a pick-up site in my neighborhood of University City. I am reading the information available to me about the proposed plan and I can't believe there would not be a proper EIR considering the absolute negative impact this is going to have on the local ecosystem. Seriously?? I find it amazing that there always seems to be fear of a full EIR when it is going to show such an obvious negative impact that it will make the proposed plan (in this case the spraying of pesticides) impossible. If the strategy is to skip the proper evaluation in order to push pesticides through (despite the negative outcome), then shame on all involved.

Be Wise has been working very hard to help with the gnat problem in a way that benefits all involved (the local ecosystem, the organic farming, etc.) and from what I've read, it sounds like it's working. Obviously the eco-friendly systems take longer, but pesticides only provide a brief fix to the problem. As we've seen over and over again, the use of pesticides will ultimately make the resistant gnats stronger and eventually will require more pesticides (it's a nasty cycle that we've gotten into before and have ended up devastating areas to the point of no return).

Please give the strategies employed by Be Wise the necessary time to work and by all means, conduct a full EIR before soaking the entire area (organic farms and all) in pesticides.

My family and I are helping to support the local economy through buying our produce by locally grown farms. Everyone is saying over and over again how important it is to San Diego to support our local farmers and local industries. I am a perfect example of one who doesn't live in that immediate area but wants to help the county at large by giving them my support. There are many others like me who love organic produce and are willing to invest in order to support local sustainable farming.

Please do not take this away from us and end up doing WAY more harm than good (and ultimately I promise, pesticides will NOT fix the gnat problem in the long term). At the VERY least, do your job and conduct a full EIR.

Thank you,
Ariane

—
Ariane Jansma, PhD
Wright/Dyson Laboratory
The Scripps Research Institute
10550 N. Torrey Pines Road, MB-2
La Jolla, CA 92037
Office: (858) 784-9726
Mail to: ajansma@scripps.edu

From: Garnet Tomich [gtomich@san.rr.com]
Sent: Monday, June 18, 2012 9:34 AM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller:

I am writing to request that a full EIR be prepared for the County's proposed Eye Gnat Ordinance and Program. The ordinance will have important environmental impacts, and I feel that a Negative Declaration is inadequate.

My family and I have been members of Be Wise Ranch's Community Supported Agriculture Program ("CSA") for 15 years. We know Be Wise Ranch is working hard to resolve the eye gnat problem **without the use of pesticides**. We, along with countless CSA supporters, would be devastated to lose this excellent organic farm!

Demand for organic farmers' produce is growing every year, so we must all try to protect the existing organic farmland in our county. Please support a pesticide-free alternative to this ordinance and a full environmental review.

Thank you for your consideration.

Garnet Tomich

From: Amy Randel [arandel@mail.sdsu.edu]
Sent: Monday, June 18, 2012 9:53 AM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance

Dear Mr. Miller,

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides on organic groups grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status and an end to the healthy, fresh produce that farm has provided my family and I for years. I am currently a member of the Be Wise Ranch CSA, which provides fresh organic vegetables to me at a pick-up site in my neighborhood.

In addition, this will mean a loss of productive organic farmland, which will be a travesty to San Diego County and its residents. It doesn't make sense that the County is rushing this ordinance without proper environmental review. Eye gnats at the golf course have been dramatically reduced in comparison with a few years ago, so steps that Be Wise has taken seem to be working. Why doesn't the County wait to see the results of what Be Wise is doing before enacting more regulations that hurt our local businesses?

Please consider the significant impact to the environment and to the health of families that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Sincerely,

Amy Randel & Michael Gates

From: Meredith White Garner [meredithagarner@gmail.com]
Sent: Monday, June 18, 2012 10:29 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; bill.hom@sdcounty.ca.gov; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration - No to Chemicals, Cancer, Death for all People, Animals and Plants living in the affected areas!!!

Dear Mr. Miller:

We care and we vote. We talk to our many friends - who also care and also vote.

We believe and hope that the work Be Wise Ranch is doing to address the eye gnats will alleviate all concerns. As noted below, these measures need to be given time to work.

As an utmost concern, as concerning as the eye gnats are for the communities affected, the spraying or application of the pesticides below will enter the water and air in these affected communities. Many of these chemicals are known or believed to cause cancer, birth defects and other serious medical conditions that are life-shortening or life-ending.

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance. The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin) on the organic crops grown at Be Wise Ranch.

In addition to the health concerns for all of the people in the affected communities, this will also mean the end of Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for our family, and a loss of productive organic farmland.

I am currently a member of the Be Wise Ranch CSA, which provides fresh vegetables to me at a pick-up site in my neighborhood.

I am especially concerned that the spraying of pesticides will impact the PEOPLE, plants and animals in the San Pasqual Valley.

Your document looks at County policies, but the impacts to Be Wise Ranch and the Valley are also in the City of San Diego. The San Pasqual Valley is a City open space park and agricultural preserve; and it supports endangered and threatened species like the Arroyo Toad, the Least Bell's Vireo, and California Gnatcatcher. The Be Wise

Ranch's use of organic farming methods is in harmony with the protection of these species, because it uses natural methods to grow crops and control pests. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area. Your environmental document gives no analysis to these impacts.

I am concerned about the health of my family and the local ecosystem, and I really want to know what these impacts will be.

I also don't understand why the County is rushing this ordinance without proper environmental review.

I understand that eye gnats at the golf course this year are way down from a couple of years ago, so it seems like what Be Wise is doing is working. Why doesn't the County wait to see the results of what Be Wise is doing before enacting more regulations that hurt our local businesses?

Please consider the significant impacts to the environment and to the health of ALL families, people, animals and plants that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you,
Meredith Garner
meredithagarner@gmail.com
16794 Circa del Norte
PO Box 3785
Rancho Santa Fe, CA 92067

Cc:

Supervisor Greg Cox - greg.cox@sdcounty.ca.gov
Supervisor Pam Slater-Price - pam.slater@sdcounty.ca.gov
Supervisor Ron Roberts - ron-roberts@sdcounty.ca.gov
Supervisor Dianne Jacob - dianne.jacob@sdcounty.ca.gov
Supervisor Bill Hom - bill.hom@sdcounty.ca.gov
Councilman Carl DeMaio - carldemaio@sandiego.gov
Steve Danon - Steve@stevedanon.com
Dave Roberts - campaign@daverobertsforsupervisor.com

6
Continues

From: sandra doyle [webmaster@prime-west.com]
Sent: Monday, June 18, 2012 10:30 AM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat ordinance

Sirs, Please do the necessary environmental impact study needed to preserve pesticide-free organic farming in San Diego County. I buy and eat almost exclusively organic produce and keeping the sources local preserves small business and consumer purchases and the taxes they provide to the city and state.

Thank you,
Sandra M. Drahman

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A.60

From: Julee Jenkins [julee.jenkins@gmail.com]
Sent: Monday, June 18, 2012 10:43 AM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Concerns

Hello,

As a long time co-op member for Be Wise Ranch, I strongly urge you to consider the needs of the farm when making decisions in regard to eye gnats. I understand they can be a nuisance, but the nature of farming at Be Wise Ranch has consistently been to support the control of eye gnats to the best of their ability. I hope you will find in favor of best practices for the ranch.

Sincerely,

Julee Jenkins

1

From: Susan Davison [sdavison@vtbs.com]
Sent: Monday, June 18, 2012 11:20 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Horn, Bill; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance

Dear Mr. Jack Miller;

I am writing to request that a FULL Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. Currently what is being done at BeWise Ranch is working, so we are requesting that you wait and see the results before rushing ahead with more regulations. We purchase organic produce from BeWise and do not wish to be eating food that is sprayed with pesticides. Should you go forward with the ordinance as it stands, we, and others that purchase organic produce from BeWise will no longer do so. You will potentially harm this local business that provides healthy, organic alternatives for our families.

Please consider the impacts of a quick decision, as it does not serve the community nor your constituents to be hasty.

Thank you.
Susan Davison

From: Diana Christianson [dianak2@wildblue.net]
Sent: Monday, June 18, 2012 11:39 AM
To: LUEG, DEH-Eyegnat
Subject: Gnats

I would like to address my comments and questions to the people complaining about the gnats. I am a small home organic gardener and I have horses, and yes, the gnats are sometimes very annoying, but it comes with the territory. They are more annoying at certain times of the day, so I plan my activities accordingly.

- Would you rather have your children breathing and eating cancer causing pesticides and herbicides?
- Where do you think the produce you eat comes from? (besides the grocery store)
- Gnats, bees and flies are everywhere, not just on organic farms. Go to a picnic at any park or beach and check it out. They are part of nature.
- Put on some insect repellent if you want to be insect free and want to put chemicals in or on your body.
- Why did you move close to an agricultural preserve and a huge dairy farm in the first place? Common sense tells us that there are going to be insects of all types in this environment.

Thank you for allowing me to voice my opinion.

Diana Christianson
760-445-5114
dianak2@wildblue.net

A.63

From: Seibert, Linda [Seibert.Linda@scrippshealth.org]
Sent: Monday, June 18, 2012 12:00 PM
To: LUEG, DEH-Eyegnat; Cox, Greg; Slater, Pam; Roberts, Ron; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration

All:

I've been following this debate regarding eye gnats and organic farms in San Diego for quite some time. It is ludicrous to think that organic farms might soon be required to spray pesticides in order to control the eye gnats, when it appears that there are other alternatives to pursue. I was under the impression from a previous study conducted that there were options that could be tried, and that were in the process of being tried, which the farms were on board with, and had in fact been reducing the numbers of gnats in the area.

I'm a member of Be Wise Ranch, and have purchased fresh organic produce from them for over ten years. I'm extremely concerned that the county is rushing to judgment, and looking for a quick and easy fix, without weighing how the spraying of pesticides will not only affect the beautiful San Pasqual Valley and it's ecosystem, but how it affects a local organic farm that supplies pesticide free fruits and vegetables that feed not only my family, but thousands of others.

Why has the city of San Diego not weighed in on this matter, when in fact, Be Wise Ranch is considered in the city confines? The Negative Declaration that was recently issued hasn't taken environmental impacts into account. More emphasis needs to be placed on what spraying pesticides in San Pasqual Valley will mean long term. I can't imagine that impacted homeowners and golfers would want to be breathing in pesticides that have been proven to cause cancer in people. That's just trading one problem for another.

Let's try doing the right thing this time, not just the easiest. Let's give Be Wise and other farms, the chance to implement other procedures before we poison yet another local ecosystem with chemicals that will blow through the air and seep into the ground affecting humans, animals, and our environment.

Thank you for your consideration.

Linda Seibert
3421 Talbot Street
San Diego, CA 92106

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A.64

From: Robin Winton [cityhomestead@yahoo.com]
Sent: Monday, June 18, 2012 12:07 PM
To: LUEG, DEH-Eyegnat

Mr. Miller,

I'm writing to ask that a full Environmental Impact Report be done for the county's proposed Eye Gnat Ordinance and Program. We ask you to please protect BeWise organic farm and the San Pasqual Valley from the toxic effects of the proposed pesticides. I understand that BeWise's gnat reduction program is working, and I think deserves a chance to continue. The spraying of pesticides would put BeWise out of business as an organic farm, and so many of us rely on local organic produce for our health, especially those people with compromised immune systems. I also don't think the farm is the only cause of the gnat problem, and don't understand the push to put it out of business and poison the environment. Surely there is a safer way to solve the gnat problem.

Thank you.

Robin Winton and family 6/18/12

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From: Rebecca Skrudland [becks137@yahoo.com]
Sent: Monday, June 18, 2012 12:12 PM
To: LUEG, DEH-Eyegnat
Subject: Support for Be Wise Ranch

To Whom it May Concern:

I have been a member of Be Wise Ranch's CSA for a year and a half. As a community member and supporter of organic farming, I urge you to seriously consider the matter of an Environmental Impact Study. Taking up the use of chemicals in an environment you and I all value is not to be taken lightly and long-term considerations are essential. In addition, organic farming is likely the future of the national and local food movement and not simply a niche market. Organic farming's value to San Diego and our local commerce and industry is great and has even better potential in future years, in my humble opinion.

While I understand that studies such as this can be costly and inconvenient, I feel the best decision is always an educated decision, and our moral compass will often lead us to a more difficult path. Please consider all options and implications before you take action to the detriment of long-established local businesses such as Be Wise Ranch.

Best,
Becky Hein
554 Sunset Dr.
Vista, CA 92081

A.66

From: Cindy and Dan Trubovitz [cdtrubo@yahoo.com]
Sent: Monday, June 18, 2012 12:49 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller

I am very disappointed and saddened that BeWise Farms may not be given consideration and time for their efforts for controlling the eye gnat situation at their farm. The consequences of chemicals being applied on their farm not only would immediately put them out of business but I find it extremely disturbing of the disregard of a complete environmental impact report. The unknown consequences on the local flora and fauna cannot go ignored especially in a agricultural preserve with a home of endangered animals.

I urge that proper consideration be given to the environment, a local business, and all the people who depend on healthy chemical-free produce.

Sincerely,

Cindy Trubovitz

4380 Via Sorpresa

San Diego, CA 92124

From: plhs1962@nethere.com
Sent: Monday, June 18, 2012 1:01 PM
To: LUEG, DEH-Eyegnat
Subject: eye gnats

Dear Supervisors,

We strongly object to bypassing an EIR review that would allow an ordinance that could result in the County spraying CHEMICAL PESTICIDES on an ORGANIC FARM in San Diego County, especially San Pasqual Valley. We purchase organic produce from a farm in this area all year long, which would not make sense if the produce is NOT organic.

Please re-think this entire issue. The good of a much larger population should outweigh a few months of annoying, naturally occurring little gnats.

Thank you for your consideration.

Darlene Graham
2353 Albatross St #108
San Diego CA 92101

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A.68

From: kirby fairfax [kirbyfairfax@yahoo.com]
Sent: Monday, June 18, 2012 2:24 PM
To: LUEG, DEH-Eyegnat
Subject: Environmental Impact Study

Hi,

I am joining thousands of other concerned citizens to request that you thoroughly investigate all possible ways of mitigating this problem without poisoning our food, land or water with chemical pesticides. There are viable methods of dealing with these pests without disrupting the county's organic farming businesses and their customers' health.

I ask that you respect our right to choose the type of food we buy and consume; by passing the ordinance you will take away our freedom to eat foods grown without toxic sprays.

As a person who has been ill for many years and for whom eating the most wholesome produce possible is a crucial part of my healing regimen, I thank you for standing up for me and my needs.

Blessings,
Kirby Fairfax
(760-870-4566)

A.69

From: B. Charles Tatum [ctatum13@cox.net]
Sent: Monday, June 18, 2012 2:27 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program - Negative Declaration

June 18, 2012

To: Mr. Jack Miller
Dept. of Environmental Health
San Diego, CA

Dear Mr. Miller-

I am writing to request a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic produce grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status and an end to the healthy, pesticide-free produce the farm provides to me and my family. Be Wise Ranch was the first - and for many years the only - Community Supported Agriculture (CSA) program in the County. I have been a Be Wise member for 21 years. For all this time Be Wise has provided fresh fruits and vegetables at a pick-up site in my Point Loma neighborhood at a price lower than the cost of organic produce in grocery stores and markets.

The spraying of pesticides in the San Pasqual Valley will not only put an end to Be Wise Organic Produce, it will also impact the land, plants and animals of the area. Be Wise Ranch's organic farming methods are sustainable agriculture. Sustainable agriculture is good for the environment. The use of natural methods to grow crops and pests keeps pesticides out of our local food chain. It maintains the local ecosystem, which supports endangered species like the Arroyo Toad and California Gnatcatcher.

A full Environmental Impact Report is needed to examine the extensive impact of the spraying of pesticides in the San Pasqual Valley as opposed to natural methods of gnat control. As a County, we need to be finding ways to reduce the use of pesticides and herbicides, not increase them. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you.

Charles Tatum
3429 Yonge St.
San Diego, CA, 92106
ctatum13@cox.net

A.10

From: Steve Emig [steveemig@gmail.com]
Sent: Monday, June 18, 2012 2:33 PM
To: LUEG, DEH-Eyegnat
Subject: eye gnat spraying

Dear Mr. Miller: I am a consumer of organic produce in San Diego County. I am concerned that the proposed chemical spraying of organic farms in the county will jeopardize the organic produce industry in the county and my ability to continue purchasing organic produce for my own use. Please look into an alternative to chemical spraying to solve this eye gnat problem and let San Diego continue to have an organic produce industry.

Sincerely, Steve Emig
1334 Greenlake Dr.

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A. 11

From: Josephine Randel [jrandel@ucsd.edu]
Sent: Monday, June 18, 2012 2:58 PM
To: LUEG, DEH-Eyegnat
Cc: Slater, Pam; Cox, Greg; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Proposed Ordinance
Attachments: Eye Gnat.doc

Please see the attached regarding the eye gnat proposed ordinance.

Josephine Randel

646 Gravilla St.
La Jolla, CA 92037
June 18, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Eye Gnat Ordinance and Program—Negative Declaration

Dear Mr. Miller:

I would like to request that a full Environmental Impact Report be prepared for the county's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was proposed provides almost no meaningful analysis of important environmental impacts that can be caused by the ordinance and is inadequate.

If you give the County the authority to spray pesticides on organic crops grown at Be Wise Ranch this will mean an end to the organic produce that I receive every week of the year from the Ranch. Besides myself there are 2800 to 3000 families who receive a weekly box of produce and who would be affected by a decision to order spraying of the organic produce. Surely this number should be given consideration against those who want the spraying.

Scientific evidence shows that the use of pesticides does harm to the environment and to the people who are affected by it. Please consider available alternatives by working with people who know about this, such as the Be Wise Ranch.

Please consider the significant impact to the environment and to the health of my family and order a full environmental impact report.

Sincerely yours,

Josephine Randel

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From: Gloria Damecki [gdamecki@gmail.com]
Sent: Monday, June 18, 2012 3:16 PM
To: LUEG, DEH-Eyegnat
Subject: Fwd: Eye Gnat Ordinance and Program -Negative Declaration

>
>
> Jack Miller
> Department of Environmental Health
> 5570 Overland Avenue, Suite 102
> San Diego, Ca 92123
>
> RE: Eye Gnat Ordinance and Program- Negative Declaration
>
> Dear Mr. Miller:
>
> It is the understanding of the community that a full study including the implementation of traps and modifications at the farm were to be completed and assessed before any negative declaration was announced. This is an outrageous breach of trust. I am requesting that a full Environmental Impact Report be prepared before you proceed in condemning the farm to use pesticides in a protected agricultural preserve and watershed area. 1
>
> I reside in this area(92025) that will be declared a vector. I have never seen an eye gnat. Traps that were put in my yard did not yield any eye gnats and yet my property value will be impacted by this decision. I am also a member of the Be Wise Ranch CSA and enjoy the organic produce. I pick up my vegetables at the farm site and I have never seen or been bothered by any insects or eye gnats while at the farm. It is one of the cleanest if not the cleanest farm I have ever visited. It appears that the Board of Supervisors does not care about the integrity of our food supply. Sending our farms to Mexico will be the result of these rash decisions. There is NO guarantee that spraying these chemicals will eliminate the problems these victims are experiencing. It is not fair to force closure of the farm if the solution is nebulous. Do the rights of the complainers exceed the rights of those who don't complain? 2
>
> I would like to suggest to the people who have eye gnat problems at their own homes to spray their yards with these recommended chemicals. They have the infestation in their lawns and gardens. I have heard residents attending these meetings that they have seen the eye gnats coming out of their own lawns! The fact that a full study has not been completed is criminal negligence and abuse of power on the part of the Supervisors. 3

Please do what is right and work with Be Wise Ranch

Gloria Damecki
2188 Pamplona Court
Escondido, Ca. 92025

From: Hal Bahls [hbahls@san.rr.com]
Sent: Monday, June 18, 2012 4:03 PM
To: LUEG, DEH-Eyegnat
Subject: BeWise
Attachments: BeWise Jack Miller 061812.doc

Please see attached letter.

4805 Tinasa Way
San Diego, California 92124

June 18, 2012

Mr. Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Proposed Eye Gnat Program and Ordinance

Dear Mr. Miller:

We are CSA customers of BeWise Ranch and obviously prefer that they continue in the business of growing and supplying organic produce to us and their many customers. For this to continue, the eye gnat problem will need to be mitigated.

It seems to us that the "long arm" of government is being extended to extremes to (1) include the eye gnat "nuisance" in with the control of vectors that are causes of "disease;" (2) to do so when by the admittance in the report that more research is needed on the problem; and (3) to empower an individual, the Director, with powers to, in effect, shut down farming during this time of experimentation with gnat control.

It seems more reasonable to us that the Board should place this ordinance on hold and to allow, under County supervision, the research to be done and to allow the farms to implement the voluntary control approaches outlined in the report and proposed ordinance. Give this two full growing season to work through and then reconsider the ordinance or a modified version at that time.

In summary, we suggest putting the ordinance on hold and take one step at a time: Do the research and implement the mitigation measures for two years and then reconsider the ordinance.

Sincerely,

/s/

Harold Bahls and Janet Summerville

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A. 14

From: Jennifer Eve [jkeve@me.com]
Sent: Saturday, June 16, 2012 6:38 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance Program

I agree with this position. Please work with our organic farmers and keep our food free from pesticides.

Jennifer Eve
5539 La Jolla Hermosa
La Jolla, CA 92037
619-743-7332

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A.75

From: Malowney, Dorothy
Sent: Wednesday, June 13, 2012 8:03 AM
To: LUEG, DEH-Eyegnat
Subject: FW: Reject the Eye Gnat Ordinance!

-----Original Message-----

From: Jones, Bobbie On Behalf Of DEH, Vector
Sent: Wednesday, June 13, 2012 6:28 AM
To: Malowney, Dorothy
Subject: FW: Reject the Eye Gnat Ordinance!

-----Original Message-----

From: Michelle Jackson [<mailto:mjnlakevu@gmail.com>]
Sent: Thursday, February 09, 2012 9:09 PM
To: DEH, Vector
Cc: Cox, Greg; Jacob, Dianne; Slater, Pam; Ron-Roberts; Horn, Bill
Subject: Reject the Eye Gnat Ordinance!

Dear Chairman Roberts and Honorable Supervisors:

I am writing to express my serious concerns about new restrictions on organic farms in San Diego. The 'eye gnat' ordinance you are considering could force organic farmers to spray chemical pesticides, reduce their farmable acreage and shut down for weeks at a time during the productive summer months. Complying with these requirements would cause organic farms to lose their certification and create a negative financial impact that could potentially put them out of business.

Organic farms provide significant benefits to the San Diego region, promoting a healthy lifestyle for residents and contributing to the local economy. I urge you to protect the future of this important industry and reject the proposed eye gnat program and ordinance in its current form.

Please give organic farmers a chance to implement safer, more proven methods to control the eye gnat issue, which has existed for decades in San Diego. The County should reject this ordinance and explore alternatives that would not negatively affect organic farmers by looking at the successful eye gnat control programs in the Coachella Valley and Yuma, Arizona.

Thank you for your consideration.

Sincerely,

Michelle Jackson

A. 16

From: Brandon Stephenson [brandon@healinghandsschool.com]
Sent: Tuesday, June 05, 2012 12:23 PM
To: LUEG, DEH-Eyegnat
Subject: Bé-Wise Ranch

To Whom it may Concern,

I have recently discovered that our local farm Be-Wise ranch is being threatened to use pesticides on their produce.

This comes to me at the highest of concern due to the fact that many of my friends and family depend on Be-Wise's Organic

Produce. The use of pesticides on produce should never be a solution. If this threat becomes reality i am convinced there will be

many citizens up in arms. We can not let poison be a part of our diet, and we will not stand for such an injustice to our health.

Please understand the gravity of this situation. The Health and well being of our community should not be taken lightly.

Thank you,

Brandon Stephenson H.H.P.

tribeofhealingarts@gmail.com

brandon@healinghandsschool.com

760-519-7970

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A.17

From: Laura Correa [laura.correa@alerotech.com]
Sent: Thursday, May 24, 2012 11:43 AM
To: LUEG, DEH-Eyegnat
Subject: Eye gnat ordinance and program

I would like to say that I am against any changes that would allow the county to use any commercial pesticides on any organic farm, even as a last resort.

Thanks,
Laura Correa

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A.78

From: Lynn Kaufman [Lynn@KaufmanSA.com]
Sent: Monday, June 18, 2012 7:07 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; diannejacob@sdcounty.ca.gov
Subject: Eye Gnat Ordinance proposal
Attachments: Be Wise Ranch concern June 2012.docx

Please find attached a letter in support of keeping our local Be Wise Ranch organic.

Thank you!

Lynn Kaufman

Via E-mail: eyegnat@sdcounty.ca.gov

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program — Negative Declaration

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin) on the organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for me and my family, and a loss of productive organic farmland. I am currently a member of the Be Wise Ranch CSA, which provides fresh vegetables to me at a pick-up site in my neighborhood.

I am especially concerned that the spraying of pesticides will impact the plants and animals in the San Pasqual Valley. Your document looks a lot at County policies, but the impacts to Be Wise Ranch and the Valley are in the City of San Diego. The San Pasqual Valley is a City open space park and agricultural preserve; and it supports endangered and threatened species like the Arroyo Toad, the Least Bell's Vireo, and California Gnatcatcher. The Be Wise Ranch's use of organic farming methods is in harmony with the protection of these species, because it uses natural methods to grow crops and control pests. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area. Your environmental document gives no analysis to these impacts. I am concerned about the health of my family and the local ecosystem, and I really want to know what these impacts will be.

I also don't understand why the County is rushing this ordinance without proper environmental review. Eye gnats at the golf course this year are way down from a couple of years ago, so it seems like what Be Wise is doing is working. Why doesn't the County wait to see the results of what Be Wise is doing before enacting more regulations that hurt our local businesses?

Please consider the significant impacts to the environment and to the health of my family that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you

Sincerely,

Lynn Kaufman
18718 Olmeda Place
San Diego, CA 92128

Cc:

Supervisor Greg Cox — greg.cox@sdcounty.ca.gov
Supervisor Pam Slater-Price — pam.slater@sdcounty.ca.gov
Supervisor Ron Roberts — ron-roberts@sdcounty.ca.gov
Supervisor Dianne Jacob — diannejacob@sdcounty.ca.gov

Supervisor Bill Horn — bill.horn@sdcounty.ca.gov
Councilman Carl DeMaio — carldemaio@saniego.gov
Steve Danon — Steve@stevedanon.com
Dave Roberts — campaign@daverobertsforsupervisor.com

A.79

From: Carrie [carrieschneider@cox.net]
Sent: Monday, June 18, 2012 8:16 PM
To: LUEG, DEH-Eyegnat
Cc: Ron-Roberts
Subject: please support organic farms

Dear Supervisors,

I am writing to express my concerns about the effect of the Eye Gnat ordinance on local organic farms. We receive a box from Be Wise Ranch every 2 weeks, delivered to a spot in North Park that is convenient to my home. I've been a subscriber to this Community Supported Agriculture delivery for several years. Since then, I have found myself eating a more healthy diet, and starting cooking with a wide variety of delicious vegetables that I'd never thought to try before. Judging from the number of boxes at the pick up site, at least 30 other homes in my immediate neighborhood would feel the loss of Be Wise Ranch.

The Eye Gnat ordinance has the potential to be a large burden to Be Wise Ranch, and puts their organic certification in jeopardy if spraying with non-organic chemicals is mandated. I ask that you consider that the ordinance, if not crafted properly, will drive local farms out of business.

Thanks for your consideration of my comments,

Carrie Schneider
2621 32ND St
San Diego CA 92104

619-282-3645
carrieschneider@cox.net

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A.80

From: Sharon Gehl [slgehl@cox.net]
Sent: Monday, June 18, 2012 9:20 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisro.com; 'Be Wise Ranch'
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller,

Please reject the Eye Gnat Ordinance and Program - Negative Declaration, and do a full Environmental Impact Report. Pesticide spraying would negatively impact organic Be Wise Ranch and the plants and animals of the San Pasqual Valley open space and agricultural preserve which supports numerous endanger species.

The county needs to also thoroughly researched other sources of eye gnats closer to the affected area, such as home orchards on large residential lots. It wouldn't be right to blame an organic farmer, and put them out of business, for something they have no control over.

Thousands of people throughout the county buy and enjoy organic produce from Be Wise Ranch. Our family, as a member of their CSA program, get a regular delivery of produce every two weeks; so what you decide affects us too. The measures that Be Wise Ranch has started putting into place seem to be working. We urge you to work with Be Wise Ranch to develop pesticide- free alternatives to this ordinance. Everyone needs time to come up with win-win solutions.

Thank you,

Sharon Gehl

4301 Hermosa Way

San Diego, CA 92103-1216

619-299-9606

slgehl@cox.net

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From: Gayle Williams [gayle@balancedaccount.com]
Sent: Monday, June 18, 2012 9:21 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance & Program - Negative Declaration

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller,

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch. This will mean the end of the Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for many families, and a loss of productive organic farmland.

As a new "convert" to the organic way of eating and having a concern for the health of the local ecosystem this is particularly disturbing to me. Be Wise Ranch's use of organic farming methods is in harmony with the protection of endangered and threatened species, because it uses natural methods to grow crops and control pests. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area.

Please consider the significant impacts to the environment and don't rush this ordinance without proper environment review. Please work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you

Gayle Williams

From: Laurel Ng [laurel.ng@gmail.com]
Sent: Monday, June 18, 2012 10:06 PM
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Program and Ordinance

Dear Mr. Miller,

Please consider a full Environmental Impact Report to be prepared for the County's proposed Eye Gnat Ordinance and Program. The information that has been gathered to date (Negative Declaration) is inadequate and does not provide a well-researched analysis of important environmental aspects that will result from the ordinance.

The ordinance allows the County to spray pesticides on the organic crops grown at Be Wise Ranch. I am a supporter and patron to Be Wise Ranch Farm. I believe in organic and sustainable farming not just for health reasons but as a means of treating the land with respect so food can be grown on the same plot of land for generations not just a few farming seasons. Be Wise is taking extraordinary measures to try to resolve the eye gnat problem. They are trying to be respectful of all the surrounding neighborhoods and have hired an expert who can solve the problem with as little impact to the environment as possible. I would not want my baby breathing in pesticides sprayed on and around my house. I would take gnats over chemicals any day. The gnats do you pose serious health issues. Gnats are natural and have been part of this land for centuries.

The 'eye gnat' ordinance you are considering could force organic farmers to spray chemical pesticides, reduce their farmable acreage and shut down for weeks at a time during the productive summer months. Complying with these requirements would cause organic farms to lose their certification and create a negative financial impact that could potentially put them out of business.

Organic farms provide significant benefits to the San Diego region, promoting a healthy lifestyle for residents and contributing to the local economy. I urge you to protect the future of this important industry and reject the proposed eye gnat program and ordinance in its current form. Why rush into a decision to spray without a thorough analysis of environmental impact? Be Wise is working diligently on this program. In fact, the eye gnats population has been reduced significantly compared to a few years ago thanks to the efforts of Be Wise.

Please respect the organic, pesticide-free lifestyle that many of us desire for our families. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance. You cannot easily reverse this type of decision once you start to spray.

Sincerely,

Laurel Ng

San Diego, CA 92116

A.83

m: Ralph Hanna [ralph.hanna@soterawireless.com]
Sent: Tuesday, June 19, 2012 7:35 AM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Roberts, Ron; dianne.jacobs@sdcounty.ca.gov; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine and Cyfluthrin) on the organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for and my family, and a loss of productive organic farmland. I am currently a member of the Be Wise Ranch CSA which provides fresh vegetables to me at a pick-up site in my neighborhood.

Your document looks a lot at County policies, but the impacts to Be Wise Ranch and the Valley are in the City of San Diego. The San Pasqual Valley is a City open space park and agricultural preserve. The Be Wise Ranch's use of organic farming methods is in harmony with this designation. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area. Your environmental document gives no analysis to these impacts. I am concerned about the health of my family and the local ecosystem, and I really want to know what these impacts will be.

Please consider the significant impacts to the environment and to the health of my family that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you,

lissa Hanna

4958 Canterbury Drive

A.84

June 16, 2012

Linda Hollingsworth, Project Manager Department of Environmental Health
5570 Overland Ave, Suite 102
San Diego, CA 92123

RCOD JUN 20 12

Dear Ms. Hollingsworth:

As a bee keeper I have a concern about the proposed eye gnat ordinance and program.

The pesticides to be used to control gnats all seem to be toxic to bees. Acephate, Cyromazine, Cyfluthrin, Diflubenzuron and Malathion are the ones to be sprayed on a barrier trap of alfalfa from April 1 to October 31. These pesticides will be used in various combinations weekly during each year.

To be effective the toxic levels on the barrier would be high enough to kill gnats at all times. The alfalfa plants will be blooming during most of this time period and are very attractive to honey bees and other beneficial insects. Foraging honey bees fly out from their hives about a mile to collect nectar but during periods of dry weather like our summers in Escondido they can go as far as three miles. There are apiary locations in Highland Valley, north Poway, San Pasqual Valley and southern Escondido that would be affected by this barrier spray program.

Can this barrier stop all gnats from flying over to the organic farm when the wind is blowing?

Can the gnats become resistant to pesticides?

What will be the extent of the control program?

Will the program include other farms in San Pasqual Valley, avocado orchards, parks, golf courses, schools and even residential properties?

Could trapping, the only effective method of controlling eye gnats that is used in Borrego and Arizona be used here?

Sincerely,

Alden Avery

Alden Avery
1625 Skyhawk Road
Escondido, CA 92029
760-745-8171

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A.85

Ramaiya, Jarrett

From: justin.mcclure@cox.net
Sent: Wednesday, May 30, 2012 8:17 PM
To: LUEG, DEH-Eyegnat
Subject: eye Gnats Escondido

SD County,

Please do not give a negative review regarding the eye gnats for the Escondido area.

I live just above the Bewise ranch and the gnats have NOT been a bother for the last 2 months.

The farmer has set traps and they are working. Do not be swayed by a few alarmists who have their own agenda.

Life is good with our organic farm and all the pluses it brings to our environment.

Justin McClure

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A. 86

RECEIVED
JUN 18 2021

June 17, 2021

Jack Miller
Dept. of Environmental Health
5570 Overland Ave. Suite 102
San Diego, CA 92123

Honorable Purveyor of Public Concern, Jack Miller:

Regarding County Proposal to Adopt a Negative Declaration and bypass a full environmental impact study.

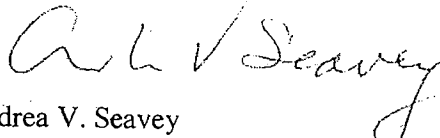
Eye Gnat Ordinance Program Negative Declaration

I'm requesting a full environmental impact report be prepared for SD County's proposed Eye Gnat Ordinance and Program. A Negative Declaration is inadequate.

A little over two weeks ago I was able to discuss the situation with Be Wise Ranch owner, Bill Brenner when I was out at the ranch picking up my member produce. He has already invested time and money into research, fly traps, and fencing. I don't understand why the county is rushing this ordinance without the proper environmental review as was initially propose to the public to control the gnats.

Spraying the farm is not only opposing the idea of San Pasquel Valley as an agricultural preserve, but also supports several threatened species of animals. What amazes me most, is that any of these proposed pesticides would be released almost in the lake bed of Lake Hodges that I understand is used downstream for drinking water! This requires a proper environmental review. There certainly are many of us dependent on Be Wise Ranch for our organic food. I've been an organic farmer myself in my back yard for 41 years here in Escondido. At 71 I'm not able to provide myself with the produce I need. The cost of organic coming from further away will be a problem for me. Please work with Be Wise. Ranch!

Sincerely,



Andrea V. Seavey
1937 Alexander Dr. Escondido 92025

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A. 87

17418 Plaza Sonada
San Diego, CA 92128

June 18, 2012

REC'D JUN 19 2012

Mr. Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Eye Gnat Ordinance and Program - Negative Declaration

~~21-01-1011-0000~~

Dear Mr. Miller;

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program.

The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance. I am concerned about the health of my family and the local ecosystem, and want to know what these impacts will be.

Please consider the significant impacts to the environment and to the health of my family that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch and all other organic farmers in San Diego County, so we can continue to have pesticide-free alternatives to our food.

Thank You,

Virginia Johnston

Virginia Johnston

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A.88

June 17, 2012

Jack Miller
Department of Environmental Health
5570 Overland Ave, Suite 102
San Diego, CA 92123

RCVD JUN 19 12

RCVD JUN 19 12

RE: Eye Gnat Ordinance and Program-Negative Declaration

Dear Mr. Miller:

When I first read of the negative ordinance regarding the eye gnat problem at Be Wise Ranch in Escondido, I was infuriated. However, I did not hear an outcry from organic farming supporters. so I thought I possibly misunderstood the negative ordinance.

Now I know I was correct in my original anger.

Organic food to me is life itself. I am now 90 years old and a productive member of our society because of organic food. I have had major health problems my entire life and only when I was able, about 40 years ago, to go on an entirely organic diet, did my health finally return.

I buy the produce of Be Wise Ranch at Jimbo's in Escondido, and have done so since the opening of the store.

The idea that one person in government, The Director of Vector Control, because of neighbor's complaints, can order poisonous sprays on a wonderfully run organic farm, which would take away their organic status, is beyond belief. Poisonous sprays will also endanger the health of endangered and threatened species in the San Pasqual Valley.

As a taxpayer and a very involved citizen of this county I ask, why is this ordinance being rushed without a full Environmental Impact report?

The organic farmers are participating in legitimate, scientific research to mitigate the problem and are assembling the necessary traps to implement proven measures to control eye gnat populations. Eye gnats at the golf course **are way down from a couple of years ago** so it seems like what Be Wise is doing is working.

I ask you to please reconsider the negative declaration and instead have **a full Environmental Impact Report**. Do the right thing and work with Be Wise Ranch on a pesticide free alternative to the ordinance.

Thank you.

Laura Glusha

Laura Glusha
6 Larry Lane
Escondido, Ca 92025
760-480 0844

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A.89

June 14 2012

RCVD JUN 19 12

County of San Diego
Department of Environmental Health

Dear Sirs;

Concerning your Eye Gnat Declaration of May 31, 2012

We operate Quail Valley Organics in the San Pasqual Valley area in San Diego County. The fourteen acre Organic Grove which we farm is our sole source of income.

We lease the property from the City of San Diego therefore we have no land value. If this Declaration is passed it would nullify our organic certificate and make it unprofitable to continue farming.

We strongly protest this action for the above reasons.

Quail Valley Organics

Dennis Lindshield



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A.90

From: Joy Williams
To: LUEG, DEH-Evegnat
Subject: Eye Gnat Ordinance and Program
Date: Tuesday, June 19, 2012 12:52:48 PM
Attachments: Eve Gnat NegDec Opposition EHC June19 2012.pdf

Hello,

Environmental Health Coalition believes the proposed eye gnat ordinance is seriously flawed and that a full EIR is needed before any ordinance is adopted. Our comment letter is attached.

1

Joy Williams
Research Director
Environmental Health Coalition
2727 Hoover Ave., Suite 202
National City, CA 91950
(619) 474-0220 x 110
Fax (619)474-1210



_____ Information from ESET NOD32 Antivirus, version of virus signature database 7233 (20120619) _____

The message was checked by ESET NOD32 Antivirus.

<http://www.eset.com>



2727 HOOVER AVE., SUITE 202, NATIONAL CITY, CA 91950 - (619) 579-0220 - WWW.ENVIRONMENTALHEALTH.ORG

June 19, 2012

County Board of Supervisors
County Administration Building
1600 Pacific Highway
San Diego, CA 92101

Re: Support Organic Agriculture in San Diego County – Require Full EIR for Eye Gnat Ordinance

Dear Chairman Roberts and Supervisors:

Environmental Health Coalition is (EHC) is a 32-year-old nonprofit organization. EHC builds grassroots campaigns to confront the unjust consequences of toxic pollution, discriminatory land use, and unsustainable energy policies. Through leader development, organizing and advocacy, EHC improves the health of children, families, neighborhoods and the natural environment in the San Diego/Tijuana region.

Summary

EHC opposes the eye gnat ordinance as currently drafted. Before the ordinance is voted upon, a full EIR is needed to allow the Supervisors and the public to consider fully and in detail the consequences of the proposed ordinance, which would give unprecedented power to a governmental agency to inflict harm on organic farming operations. In attempting to justify this new power to chemically assault organic farms, the ordinance arbitrarily redefines “vector,” a term that is used universally to mean disease-carrying organisms, to include the non-pathogenic eye gnat. It fails to clearly identify the “last resort” condition that would allow county government to wield this extraordinary new power. Beyond the damage to good government that is represented by the draft ordinance, there are potential traffic and growth-inducing impacts, which require environmental review under CEQA.

Definition of Vector

The proposed eye gnat ordinance would give county government the authority to use pesticides that are not approved for use on organic farms, thereby rendering an organic farm no longer organic. As the draft ordinance itself acknowledges, the county cannot take this extremely harmful step unless eye gnats are designated a “vector.” Eye gnats are **not** vectors, and to legislatively change the meaning of the word sets a dangerous precedent for expanding governmental authority beyond the original and legitimate intent of the laws designed to control vectors. If any nuisance that emanates from a farm is potentially a vector, then surely Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin are also vectors, and we need ordinances to control them as well.

“Last Resort” Condition Not Defined

Eye Gnat NegDec EHC Opposition - 1 -

EMPOWERING PEOPLE. ORGANIZING COMMUNITIES. ACHIEVING JUSTICE.

EMPODERANDO A LA GENTE. ORGANIZANDO A LAS COMUNIDADES. LOGRANDO LA JUSTICIA.

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Chapter 4 of the proposed ordinance authorizes the Director to take steps, including ordering the use of pesticides that would result in loss of organic certification or ordering an organic grower to entirely cease production of a crop, in a last resort case. That is, if the "eye gnat nuisance" is deemed to be not "sufficiently abated," the Director may effectively shut down an organic operation. However, the eye gnat nuisance condition is not defined, nor is it clear when the nuisance is sufficiently abated. If one eye gnat larvae is found, is this a nuisance? If one neighbor continues to complain, is it not sufficiently abated?

3

Eye Gnat Ordinance May be Growth Inducing

Adoption of the eye gnat ordinance would signal that residential encroachment on agricultural land is encouraged and supported by the County. Thus it has the potential to induce growth and added traffic on formerly rural roads. This impact must be analyzed in the environmental review for the draft ordinance.

4

Economic Impact on Organic Agriculture Must be Assessed in an EIR

The Negative Declaration for the draft ordinance dismisses the potential loss of organic farmland and livelihoods, as well as the loss to consumers of locally grown organic produce, that could be caused by the use of non-approved pesticides on an organic farm. To suggest that organic growers could simply dig up row crops and plant trees or raise livestock is a callous dismissal of the research, planning, and years of soil preparation and experience that go into the choice of crops. Before adoption of any ordinance, a full assessment of the potential economic impact upon our region's organic farmers and farms must be completed.

5

The Ordinance and Environmental Review are Premature

The Farm and Home Advisor is still in the process of doing studies to determine which methods of deterring eye gnats are effective and should be incorporated into the BMP practices for control of eye gnats. The proposed ordinance is premature and may be unnecessary.

6

Pesticide Impacts on Human Health and Groundwater Must be Evaluated Further

Three Pesticides Identified as Groundwater Contaminants. The California Department of Pesticide Regulation (DPR) maintains a list of the pesticides, registered for agricultural use in California, which meet one or more of the DPR criteria for chemicals likely to leach into groundwater. Three of the pesticides that the Director may order to be used on organic farms -- Acephate, Malathion, and Cyromazine -- are on the DPR list. Use of these pesticides in the sandy soils where eye gnats are found will increase the probability that the pesticides will leach into

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groundwater, based on their high water solubility and the length of time they require to break down. Source:

<http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/eh0902.pdf>

Human Health. Two of the pesticides, Acephate and Malathion, are organophosphates, which are not selectively toxic to insects but affect the human nervous system as well. Human symptoms of exposure to organophosphates include the following, as summarized in the PAN Pesticide Database:

- Excessive salivation, sweating, rhinorrhea and tearing.
- Muscle twitching, weakness, tremor, incoordination.
- Headache, dizziness, nausea, vomiting, abdominal cramps, diarrhea.
- Respiratory depression, tightness in chest, wheezing, productive cough, fluid in lungs.
- Pin-point pupils, sometimes with blurred or dark vision.
- Severe cases: seizures, incontinence, respiratory depression, loss of consciousness.
- Cholinesterase inhibition.

http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC32924

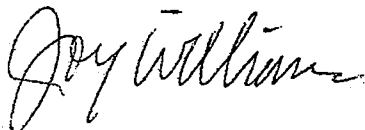
PAN's Source: Recognition and Management of Pesticide Poisoning, 5th edition, U.S. EPA, Chapter 4.

Use of any of these pesticides should be limited to situations where real threats to human health exist and cannot be controlled by other means. At the least, evaluation of these pesticides and their potential to harm human health or contaminate groundwater must be included in the environmental review for this proposed ordinance.

Public Transparency of Board of Supervisor Actions

The public is entitled to know how the Board of Supervisors votes on this issue. According to Section 12 of the proposed ordinance, the Board's voting results will be published in the *San Diego Commerce*. This newspaper is not available at newsstands and does not appear to have a current website. It is unclear how a member of the public would access this newspaper to determine how Supervisors voted. At minimum, the vote should be published on the County's own website.

In sum, the proposed eye gnat ordinance requires a full EIR before any further action is taken to adopt it. Thank you for the opportunity to comment on this matter.



Joy Williams
Research Director

Cc: Linda Hollingsworth

Eye Gnat NegDec_EHC Opposition

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continues

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A.91

From: Eric Paysen [epaysen@gmail.com]
Sent: Thursday, June 21, 2012 10:58 AM
To: LUEG, DEH-Eyegnat
Subject: Fwd: Proposed negative declaration regarding eye gnats in Escondido
Attachments: Bugg_EyeGnat_Comment_v.7.doc; Resume.DOC

Sent this yesterday but appear to have left this email off the list. Thank you for your consideration.
Eric Paysen

----- Forwarded message -----

From: Eric Paysen <epaysen@gmail.com>
Date: Wed, Jun 20, 2012 at 4:17 PM
Subject: Proposed negative declaration regarding eye gnats in Escondido
To: greg.cox@sdcounty.ca.gov, pam.slater@sdcounty.ca.gov, ron-roberts@sdcounty.ca.gov,
dianne.jacob@sdcounty.ca.gov, bill.hom@sdcounty.ca.gov, carldemaio@sandiego.gov,
steve@stevedanon.com, campaign@daverobertsforsupervisor.com
Cc: Bill Brammer <bb.bewise@yahoo.com>

To whom it may concern,

I am writing on behalf of Be Wise Ranch in regard to the proposed negative declaration and best practices regarding the county plan for eye gnats. I have reviewed and commented on the attached document which was originally prepared by Dr. Robert L. Bugg. I wholeheartedly agree in my expert opinion with the content and intent of this document and have added some additional thoughts within the document. In addition I have attached my resume for your information regarding my expertise in entomology and environmental matters pertaining to the control of insect pests. Please contact me if I can be of any assistance in this approval process.

Sincerely,

Dr. Eric S. Paysen
239 Willowspring Dr. N.
Encinitas, CA 92024
1(619)-520-9793

Curriculum Vitae-Eric Scott Paysen October 2011

239 Willowspring Dr. N
Encinitas, CA 92024

Phone: 619-520-9793
E-Mail: epaysen@gmail.com

Education

- Ph.D. Entomology, Clemson University, 2007, 4.0/4.0
Thesis topic: Ecology and population dynamics of ant community properties at forest edges in the Great Smoky Mountains National Park.
- M.S. Entomology, Clemson University, 1999, 4.0/4.0
Thesis topic: Cytogenetics, ecology, and evolution of the black fly pest *Simulium parnassum* Malloch.
- B.S. Biology, Winthrop University, May 1997, 3.4/4.0
Research interest: Behavior and biological control of *Leptoglossus phyllopus*, an agricultural pest

Honors and Awards

- Young Scientist of the Year, Bayer Environmental Science, 2006
South Carolina Rural Rehabilitation Corporation Fellowship, Clemson University, 2005, 2006, 2007
Best Graduate Student Presentation Award, 51st Annual Meeting of the South Carolina Entomological Society, 2005
Cochran Scholarship Award for Outstanding Graduate Student, South Carolina Pest Control Association, 2003, 2005
Conservation Scholarship Award, South Carolina Wildlife Federation, 2005
Best Graduate Student Presentation Award, 50th Annual Meeting of the South Carolina Entomological Society, 2004
Award for Outstanding Graduate Student, South Carolina Entomological Society, Cochran Award, 2004
Pi Chi Omega Scholarship Award, 2004
Ph.D Scholarship Award, National Conference on Urban Entomology, 2004
Pittman Fellowship Award, Clemson University, 2004
Insect Photo Salon, 3rd and 4th place entries, Southeastern Branch of the Entomological Society of America, 2004
Terminix Fellowship Award, 2004, 2006
Creighton Fellowship Award, Clemson University, 2001
Best Graduate Student Presentation Award, Carolina Area Benthological Workshop, 1999
McKinney Fellowship Award, Clemson University, 1997
Sigma Xi Undergraduate Research Award, 1997
Best Undergraduate Presentation Award, 41st Annual Meeting of the South Carolina Entomological Society, 1995

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Continued

Award for Outstanding Academic Achievement, Winthrop University
Ecology, 1997
Organic Evolution, 1996
Entomology, 1995
Microbiology, 1995
Cell Biology, 1995
Santee-Cooper Environmental Scholar Award, 1995

Teaching Experience

Instructor, Lloyd Pest Control, Continuing education courses approved by the California Structural Pest Control Board - Pesticide safety training series, MSDS your right to know, Respirator training, Ant biology and control, Control of bees wasps and hornets in and around structures, Drywood termite biology and control, Subterranean termite biology and control, Termite biology and identification, Rodent biology and control, Cockroach biology and control, Bedbug biology and control, Flea biology and control, Termite inspections, Biology and control of nuisance flies, Biology and control of the pocket gopher, IPM Basics. 2007 - present.
Instructor, Lloyd Pest Control, Basic training for new employees, 2007 - present
Instructor, South Carolina PCO School, Workshop - Insect identification, 2006, 2007
Instructor, Master Pest Control Technician – Short Course, Clemson University, Ants: Identification and Management, 2002, 2003, 2004, 2005
Graduate Teaching Assistant, Insect Behavior, Clemson University, 2003, 2005
Invited Guest Lecturer, Clemson University
Ant taxonomy and identification, Urban Entomology Lab., 2002, 2006
Ant biology and control, Urban Entomology, Three lectures, 2002, 2006
Ecology of Invasive Species, Plant Form and Function, 2006
Locomotion, Insect Behavior, 2005
Neural and Hormonal Mechanisms, Insect Behavior, 2005
Hymenoptera, Coleoptera, and Neuroptera, General Entomology, 2004
Proctodaeum: morphology and evolution, Insect Morphology, 2004
Blattidae and Formicidae, Medical and Veterinary Entomology, 2004
Insect metamorphosis and diversity, Six-legged Science, 2004
Formicid ecology and evolution, Environmental Entomology, 2003
Graduate Teaching Assistant, General Entomology Laboratory, Clemson University, Four Semesters, 1997-1998

Competitive Grants

Bayer Environmental Science, Young Scientist of the Year 2006 (\$13,500)
King Endowed Memorial Grant, Clemson University, 2005 (\$1300)
King Endowed Memorial Grant, Clemson University, 2005 (\$395)
Nettles Endowed Memorial Grant, Clemson University, 1998 (\$700)

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Affiliations

Entomological Society of America, 1999-present
South Carolina Entomological Society, 1998-present
Sigma Xi Scientific Research Society, Associate Membership, 1998-present
Clemson Entomological Society, 1997-2007
Beta Beta Beta Biological Honor Society, 1997

Relevant Employment

Technical Director, Lloyd Pest Control, San Diego, CA, 2007-present

Major duties include: Providing expert technical guidance for the control of structural pests to sales, service, and management personnel. Design, test, implement, and maintain industry leading pest control protocols. Develop and deliver training for employees in technical, safety, regulatory, and quality control subjects. Manage the quality control department. Plan and manage the company safety program. Provide outreach and training for customers on issues involving bed bugs and other structural pests.

Research Specialist, Clemson University, Urban Entomology, 1999-2007

Duties include: Leadership and management of various field and laboratory research projects dealing with the control and ecology of ants and termite baiting systems

Relevant experience: Data management, work with industry contracts, hiring, training, and supervising staff, and collaboration between industry and multiple universities

Laboratory Technician, Entomology, Winthrop University 1996-1997 (part-time)

Duties include: Developing protocols, and collecting data involved with insect feeding research on agricultural pests

Assistant Lab Technician Entomology, Clemson Coastal Research and Extension Station, Charleston, SC, Summers 1995, 1996

Duties include: Collection of data in agricultural research

Community Service

Volunteer, Insect Festival at Quail Botanical Gardens, Encinitas, CA, 2007, 2008, 2009, 2010, 2011

Volunteer, Insect day at the Childrens Polinski Center, 2007

Volunteer, Bug Night at A.R. Lewis Elementary School, Live insect display, 2006

Mentor, West Oak High School Senior Project, Insect Ecology, 2005, 2006

Organizer, As president led the Clemson Entomological Society's participation in Bug Night at Forest Acres Elementary School. Led 12 volunteers, 600 participants, 2004

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Speaker, Conservation ecology discussion and techniques demonstration, Great Smoky Mountains National Park, High School Intern Program, 2003
Tour Guide/ Speaker, Clemson Arthropod Museum, 2003
Judge, Science Fair at Pendleton Elementary School, 2002
Volunteer, Great Smoky Mountains National Park. All taxa biological inventory project (Formicidae, Isoptera, Blattodea), 2000-2006
Speaker, Bike safety/maintenance and bike trail ride leader. Cub Scouts, 2001
Volunteer, Trail maintenance, Clemson Experimental Forest, 1997-2004
Speaker, Science day at Kellett Elementary School, 2001
Tour Guide, Junior Academy of Science, 1998

Professional Self-development

The Ant Course 2001 of the California Academy of Sciences. Students were accepted on a competitive basis. Intensive 10 day workshop on formicid taxonomy. Portal, AZ.
Clemson University debate team member, The Annual Meeting of the Entomological Society of America, Ft. Lauderdale FL. 2002. Topic: Publicly funded mosquito control efforts in urban areas should take precedence over private concerns regarding pesticide exposure.

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Professional Service

Moderator, Annual Meeting of the Entomological Society of America, 2006
Search Committee Member, Department of Entomology Soils and Plant Sciences, Clemson University. Turf and Ornamental Entomologist, 2006
Resolutions Committee Member, South Carolina Entomological Society, 2006
Organizer/Representative, Department of Entomology, Soils, and Plant Sciences, Clemson University, Graduate Education Expo, 2004
President, Clemson Entomological Society, 2003-2004
Vice-President, Clemson Entomological Society, 2002-2003
Selection committee, Cochran Award for Excellence in Entomology, South Carolina Entomological Society 2002
Moderator, Annual Meeting of the South Carolina Entomological Society, 2000

Professional Presentations

Paysen, E.S. 2010. Bed Bug Resurgence: Revenge of the Bed Bug. Webinar. The Professional Association for Chartered Property Casualty Underwriters. (Invited).
Paysen, E.S. 2010. Career Paths in Industry: a Technical Director's Perspective. Entomological Society of America Annual Meeting. San Diego, CA (Invited).

- Paysen, E.S. 2009. Practical Approaches to Bed Bug Control. 18th University of California Riverside Urban Pest Management Conference. Riverside CA **(Invited)**.
- Paysen, E.S. 2008. Biology and Control of the Bed Bug *Cimex lectularius*. San Diego Zoo, San Diego CA **(Invited)**.
- Paysen, E.S., W. K. Reeves, P.A. Zungoli, and E. P. Benson. 2006. Ploymorphism in the odorous house ant. Entomological Society of America Annual Meeting. Indianapolis, IN
- Nelder, M. P., E. S. Paysen, P. A. Zungoli, and E. P. Benson. 2006. Fear and loathing in South Carolina: Emergence of the introduced ant *Pachycondyla chinensis* (Ponerinae), as a public health threat. Entomological Society of America Annual Meeting. Indianapolis, IN
- Zungoli, P. A., E. P. Benson, A. S. Tebeau, and E. S. Paysen. 2006. Management strategies for the invasive ponerine ant, *Pachycondyla chinensis* (Emery) (Hymenoptera: Formicidae). Entomological Society of America Annual Meeting. Indianapolis, IN
- Paysen, E. S. 2006. Using community ecology to understand ant pests. Annual Meeting of the National Pest Management Association. Grapevine, TX **(Invited, Award Winner)**
- Paysen, E. S. 2006. Invasive ants threatening biodiversity in South Carolina. Symposium – focus on biodiversity. 52nd Annual Meeting, South Carolina Entomological Society, Hickory Knob State Park, SC **(Invited)**
- Nelder, M. P., E. S. Paysen, P. A. Zungoli, and E. P. Benson. 2006. Adverse immune response caused by stings of *Pachycondyla chinensis* (Emery): an invasive ant in South Carolina. 52nd Annual Meeting, South Carolina Entomological Society, Hickory Knob State Park, SC
- Paysen, E. S., M. P. Nelder, P. A. Zungoli, E. P. Benson. 2006. Natural history, community ecology, and medical status of an invasive, stinging ant pest, *Pachycondyla chinensis*, in the United States. National Conference on Urban Entomology, Raleigh, NC.
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References

- Mr. Herb Field, Chief Operations Officer, Lloyd Pest Control
San Diego CA 92110. (619)-843-3744 herb.field@lloydpest.com
- Dr. Patricia Zungoli, Clemson University Entomology Department,
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- Dr. Eric Benson, Clemson University Entomology Department, Clemson
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- Dr. Peter Adler, Clemson University Entomology Department, Clemson
SC 29634-0365. (864)-656-5044. padler@clemson.edu
- Dr. Paula Mitchell, Winthrop University Biology Department Rock Hill,
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Via E-mail: eyegnat@sdcounty.ca.gov

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

June 19, 2012

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller:

Here are my comments on the proposed San Diego County "Negative Declaration and Initial Study" regarding eye gnats (*Liohippelates collusor* [Townsend], *Liohippelates* spp., and *Hippelates* spp. (Diptera: Chloropidae).

I have a Ph.D. in entomology from UC Davis, and have extensive experience in research, extension, and implementation of sustainable agricultural practices, including least-toxic pest management, cover cropping, hedgerow design and establishment, biological control, native pollinator conservation, and ecological soil management. I have authored over fifty refereed scientific publications on these and related themes. I have worked with a wide range of crops, including alfalfa, vegetables, potatoes, pecans, almonds, walnuts, and winegrapes. I was co-originator and implementer of the Biologically Integrated Orchard Systems (BIOS) projects, which involved farmer-to-farmer exchanges and farmer-scientist teams and were the first multi-media agricultural pollution reduction projects in the USA. I also co-originated the Biologically Integrated Farming Systems competitive grants program, which expanded this approach to numerous crops in California.

In addition Dr. Eric Paysen has reviewed and commented on this document as well as the proposed county documents and research. Dr. Paysen holds both Masters and Ph.D. degrees in entomology. He has extensive experience in conservation ecology, agricultural integrated pest management, fly genetics, and population dynamics. Dr. Paysen is currently employed as the technical director for a large pest control firm where he designs and implements environmentally sound pest control programs.

I am undertaking this work for Mr. Brammer on a *pro bono* basis because I believe that his case has great merit and that public policy should be based on the best science and reasonable process.

I am very concerned about the proposed negative declaration and the 2010 and 2011 reports (by Mr. Bethke, the U.C. Cooperative Extension Floriculture and Nursery Farm Advisor and colleagues) on which this proposed negative declaration is based. My general concerns are:

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(1) The proposed negative declaration essentially (through it's recommendations) identifies Be Wise Ranch as the sole source of the eye gnat problem, when a reasonable reading of the relevant studies, including some of Mr. Bethke's, would indicate that residential plantings, the golf course, seasonal wetlands, and the San Dieguito River are all major sources. This is not only logical based on the biology of these flies but is also supported by eye-witness accounts of eye gnats in the area prior to the present farming practices. The situation calls for reasoned, community-wide, integrated approaches rather than draconian measures against Be Wise Ranch. Long ago, Dr. E.F. Legner and Dr. E.C. Bay, both entomologists at UC Riverside, wrote about the importance of an integrated, *community-wide* approach to eye gnat issues, and these statements should provide guidance in the present case. A unified, community-wide effort is necessary to permanently abate the problem (Legner, E.F. & Bay, E.C. 1970. Hippelates Eye Gnat Breeding in the Southwest. California Agriculture 24(5):1, 4-6.). Bay and Legner (Bay, E.C. & Legner, E.F. 1963. The prospect for the biological control of *Hippelates collusor* (Townsend) in southern California. Proceedings of the California Mosquito Control Association, Inc. 31:76-79) also wrote of the importance of eye gnat breeding habitats *other* than tilled agricultural fields: "Hippelates are more dependent on living grasses than heretofore realized . . . disturbed sandy soil, although an important breeding site, is less a prerequisite to Hippelates development than commonly thought . . .". Similarly, Dr. Mir S. Mulla (Mulla, M.S. 1962. The breeding niches of *Hippelates* gnats. Annals of the Entomological Society of America 55(4):389-393) reported that, in addition to breeding in irrigated, tilled farmland, eye gnats also reproduce in certain non-tilled areas, including golf courses, new lawns, ditch banks, canal shoulders, and alfalfa-barley fields.

(2) Mr. Bethke and colleagues have used sampling regimes that have not systematically assessed important *Liohippelates collusor* breeding habitats in The Vineyard Golf Course and associated seasonal wetlands. These omissions include failure to locate emergence traps in the irrigated, middle portions of the golf course fairways, where divots, sand additions, irrigation, and abundant dead, green matter (comminuted by mowing) combine to produce excellent habitat for *Liohippelates*. Mr. Bethke and colleagues have instead restricted their emergence trap placement to the periphery of fairways, where disturbance, plant growth, divots, sand introduction, irrigation, and plant growth are all much less. In addition there has been an extreme paucity in sampling effort in these areas with only a few poorly placed traps in comparison to the numerous samples taken near or on the farm. It is simply not legitimate to extrapolate count data from such traps to the entire golf course.

(3) Mr. Bethke and colleagues have largely ignored the San Dieguito River bed as a potential source of *Liohippelates collusor*. Specifically, Mr. Bethke and colleagues only placed two emergence traps in the riverbed, and these were positioned in roadside settings that are certainly not representative of the riverbed as a whole. Rather, the traps were positioned in a roadside setting

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that does not entail much water or vegetation, or disturbance regimes typical of the riverbed as a whole. Dr. Legner's earlier studies have shown that stream banks are major breeding sites for eye gnat (see point 1 above). Again this sampling regime is not scientifically sound and should certainly not be used to base policy which will cripple a local business.

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- (4) The proposed ~~policy~~ negative declaration dictates large increases in the collar trap density over the density originally proposed by the Floriculture and Nursery Farm Advisor. These increases appear to be arbitrary and, again, not based on sound experimental design, analysis, and interpretation. The proposed negative declaration would also cause a great increase in cost to the farmer not only because of the increase in density but also because they would include within-field traps that are more difficult to maintain than those on the field edges and on the farm perimeter. Mr. Bethke's original recommendation, contained in email messages to Mr. Brammer of January 11 and 12, 2012, was for 2,000 collar traps arranged on the perimeter of the farm, at intervals of 10' - 30', depending on which crops were growing and whether the field was covered with plastic mulch. By contrast, in the 2011 report (issued in May 2012), in the recommendation for eye gnat control for Be Wise Ranch, the number, for reasons unspecified, was increased to 6,900 collar traps to be arrayed in two offset rows of at 10' apart, plus 43 collar traps per acre in all tilled fields. In addition, all dried and green matter was stipulated to be removed from the farm. No scientific basis has been provided for the increases in trap densities of the other changes. The original plan requires ca \$600 per acre, whereas the arbitrarily and capriciously revised plan would cost upwards of \$3,500 per acre, and would render even strawberry production a net loss operation of \$2,500 per acre. The proposed management regimes will make it economically impossible to farm organically in Escondido. This has been clearly established through data provided by Bill Brammer of Be Wise Ranch.

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- (5) The insecticide Ecotrol does not work against eye gnat based on Mr. Bethke's data (2010 report, tables 4, 5, 6), yet Ecotrol is prescribed for alternate-week spraying under the proposed negative declaration. This is clearly in opposition to modern integrated pest management practices and needlessly places unnecessary pesticides in the environment. It is especially concerning that the county would mandate such needless applications in close proximity to a sensitive riparian habitat.

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- (6) In the 2010 report, Mr. Bethke and colleagues have presented count data from collar traps in a very misleading manner, including the truncation of a graph (Fig. 4) that, if presented in full, would show that by far the highest eye gnat densities are encountered at sites miles away from Be Wise Ranch, including one site immediately adjoining Kit Carson Park.

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- (7) The practices promoted in the proposed negative declaration are at marked variance with trapping regimes successfully used in Coachella, CA, and Yuma, AZ, in which cases a single trapline is maintained along the agricultural-suburban interface, with additional traps in parks and golf courses.

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- (8) If the proposed policy is implemented, the organic farmer will immediately be found to be out of compliance; will have no further regulatory recourse; will have to undertake costly, ineffective practices that will put him in violation of his lease and in violation of Organic production standards; will be forced to undertake practices that impair surface waters; and, ultimately, will be put out of business.
- (9) 2012 sampling by Mr. Bethke has shown a 98% reduction in counts of eye gnats in five collar traps on The Vineyard Golf Course, including traps that immediately adjoin Be Wise Ranch. This suggests that the traplines and other control measures already in place on the farm are working excellently (Bryan Vander Mey, Staff Research Associate, UC Cooperative Extension, FAX message, June 13, 2012). This information further suggests that the additional burdensome, unreasonable, and ineffective measures and practices envisioned under the proposed negative declaration would be superfluous and should be rejected.

In summary, based on readily available science, the proposed negative declaration is seriously flawed in that it will require ineffective pesticide applications, fail to solve the eye gnat problem in the community and is not a financially sustainable or environmentally sound proposal. ~~an~~ For these reasons the proposed negative declaration ~~should~~ ~~should-d~~ be rejected. If implemented, the proposed negative declaration will drive a highly productive organic farm out of business, ~~and will definitely not solve the eye gnat problem in Escondido.~~ This would occur at a time when collar trap sampling is clearly showing the current practices at Be Wise Ranch are drastically reducing the incidence of eye gnats emanating from the farm. Solving the eye gnat problem in the long run will require a conscientious, sober, community-wide commitment and systematic control efforts in other major breeding habitats in the area, complementing the excellent and effective efforts that have already been made by Bill Brammer and his colleagues at Be Wise Ranch.

Thank you for considering my comments.

Sincerely,

Robert L. Bugg, Ph.D.
Entomologist
1555 Pinnacles Place
Davis, CA 95616-6660
C 530-219-7834

A.92

From: Jane Sooby
To: LUFG, DEH-Evegnat
Cc: "Jane Sooby"
Subject: Eye Gnat Ordinance and Program
Date: Wednesday, June 20, 2012 12:48:57 PM

Attn. to: Eye Gnat Ordinance and Program

June 20, 2012

Dear San Diego County Board of Supervisors,

This comment is submitted by the Organic Farming Research Foundation (OFRF), a national non-profit whose mission is to foster the improvement and widespread adoption of organic farming systems. OFRF has privately funded organic research and education projects across the country since 1990 and also maintains a strong policy program.

OFRF has been informed that the San Diego County Board of Supervisors is considering an ordinance that changes the definition of "vector" in the County Code to include eye gnats. Among a number of other things, this ordinance sets forth a number of eye gnat abatement measures that a farmer must implement in the case that "a substantial number of eye gnat complaints" are received.

We have spoken with UC Cooperative Extension specialist Jim Bethke and understand that eye gnats have in the recent past been a nuisance in the communities of Jacumba and Escondido. Because there are organic farms adjacent to these communities, people think that these farms are the source of the eye gnats.

OFRF is very concerned that the ordinance being contemplated by the County singles out organic farmers as the only source of eye gnat emergence. San Diego County is home to 347 organic farms registered with the State of California, farming a total of 6,700 acres. Organic sales in San Diego County in the year 2011 were \$28.6 million. Organic farming is an important segment of San Diego County's economy.

Land under organic management provides a number of environmental benefits in addition to producing food, fiber, and feed. OFRF has evaluated the scientific literature and documented that organic farming builds soil quality, maintains water quality, protects biodiversity, reduces human exposure to synthetic agricultural chemicals, and has potential to mitigate climate change by sequestering carbon.

From this perspective, OFRF offers these comments on the proposed Ordinance Amending the San Diego County Code of Regulatory Ordinances Relating to Vector Control.

1. OFRF finds it problematic that organic farms are singled out in the proposed ordinance. The assumption seems to be that non-organic farms or other potential habitats

--such as landscaping, parks, or golf courses--will never be a source of eye gnat emergence. To focus the ordinance exclusively on organic farms may tie the County's hands in terms of future enforcement if non-organic farms or other landscape types are found to be eye gnat breeding areas.

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We note that the 2011 Eye Gnat report indicates a substantial number of eye gnats were trapped in areas near residential landscaping. This suggests that focusing control efforts exclusively on organic farms may not be adequate to solve the eye gnat problem.

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2. We've also observed that the Eye Gnat Complaints in South Escondido have been minimal from Oct. 16, 2011, to the present. This suggests that 1. either existing control measures or climate conditions are reducing the eye gnat problem; and 2. that the County has adequate time to further refine its public policy regarding eye gnats.

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3. The primary "cultural control" recommended by UC Cooperative Extension to manage eye gnats is to "Reduce the amount or stop tilling fresh or dry organic matter into the soil entirely." This suggestion contradicts the primary soil-building, fertility, and pest management strategy utilized by organic farmers worldwide: growing and incorporating organic matter, usually in the form of a cover crop. We encourage UC Cooperative Extension personnel to investigate other options for eye gnat management that do not undermine the best management practices of organic farmers, and we suggest that the County not adopt such a recommendation as part of its public policy.

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4. OFRF is very concerned that the County is poised to implement policy that would require organic farmers to apply synthetic pesticides that are not allowed under the National Organic Standards and would disqualify the ground from being certified organic for a period of three years after application. Such a policy could have a devastating impact on the viability of organic farms in San Diego County.

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5. The existing definition of "vector" is "an animal capable of transmitting the causative agent of human disease." This is the commonly understood, medically and biologically accepted definition of the word "vector." Eye gnats are not considered to be "vectors" because they do not carry agents of disease. This is a native insect that has been occupying the region probably since humans first arrived. They may be a nuisance, but it is inappropriate to redefine the word "vector" to include eye gnats when they have not been shown to be a causative agent of human or animal disease.

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Inserting the language " 'Vector' also includes eye gnats" into Chapter 2 of the County Code has no basis in fact or the English language. We understand that, in order for the County to assume the powers to enforce eye gnat abatement measures on organic farmers, the word "vector" must be defined in such a way as to include eye gnats; however we think that this is an inappropriate modification of word meaning.

It is clear from the Eye Gnat reports that UC Cooperative Extension personnel and the neighbor organic farms have made tremendous efforts to manage the eye gnats. It appears that these efforts have been largely successful, particularly in Escondido.

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We urge that the Board of Supervisors take the time to revise the proposed ordinance so as to reduce its burden on organic farmers, and that the Board exercise good judgment guided by valid science in setting public policy regarding eye gnat management.

Sincerely,

A.93

From: MC Hagerty
To: LUEG, DEH-Evegnat
Cc: Cox, Greg; Jacob, Dianne; Slater, Pam; Ron-Roberts; Horn, Bill; carlde Maio@san diego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Be Wise Eye Gnat Problem
Date: Tuesday, June 19, 2012 12:11:57 PM

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

I am writing to request that a full Environmental Impact Report be completed about the Eye Gnat Ordinance Program. The Negative Declaration that was prepared is inadequate and offers no meaningful solutions that keep Organic Standards intact. This is a devastating report and its consequences are equally bad for the large organic farming community located in San Diego County. Organic farmers will be upset over the possible use of pesticides that will be required just to calm a few households not educated about the harms of trying to control pests by poisoning them with pesticides. Ultimately the pests build up resistance and newer, stronger pesticides will be required. In the mean time organic farming in San Diego County will be done. What will be the economic results to the county by these short-sighted measures. How many jobs will be lost?

The harms of pesticides are only now being recognized and are found to be extremely harmful to the soil, to the air and ground water and to the ocean. I have not even begun to mention all the human health problems related to high pesticide residues on our foods and in our environment. Have the Supervisors been paid off by the chemical companies who are trying to destroy the organic movement? Or maybe the homeowners are contributing to the re-election campaigns of the Supervisors?

If this is passed in its current form, this ordinance would:

1. Force organic farms to spray pesticides whenever an unspecified number of complaints from neighbors are received. This strips the farm of its organic certification and affects the health of surrounding populations.
2. Give one person complete control over the (previously) organic farm and its operations. The Director of Vector Control has full power to seek relief from applicable, validated and practicable control measures. This can be achieved by ordering a fallow period, changing a farmer's crop selection or by ordering the implementation of a "barrier" crop.
3. Reduce farmable acreage by possibly mandating the use of "barrier" crops, which would have a negative financial impact on farmers.
4. Shut organic farms down during peak growing season, possibly for weeks during the summer, the peak growing season. This fallow period could effectively close most organic farms in San Diego County.
5. Target organic farms without a scientific basis by solely acting

on neighbor complaints, and the decision of a single director responding to these complaints. The director has the authority to override input from scientific or agricultural agencies knowledgeable about organic farming.

The solution is to give the farms sufficient time to implement the voluntary community wide measures and reject the ordinance in its current punitive form. Local supermarkets, Whole Foods, People's Organic Co-op and Jimbo's are promoting organics and are against this ordinance.

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Sincerely,

MC Hagerty
PO Box 131133
Carlsbad, CA 92013

A.94

From: Erick Altona
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program - Objection to Negative Declaration
Date: Wednesday, June 20, 2012 3:13:41 PM
Attachments: Altona ltr 6-19-12.pdf

Dear Mr. Miller,

Please see attached letter.

Erick R. Altona

Lounsbery Ferguson Altona & Peak, LLP

960 Canterbury Place, Suite 300

Escondido, CA 92025

USA

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Thank you in advance for your cooperation.

ERICK ALTONA
2302 Meadow Lark Drive
San Diego, CA 92123
(760) 743-1226 (x106) work
(760) 443-4059 cell

VIA EMAIL eyegnat@sdcounty.ca.gov

June 19, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Eye Gnat Ordinance and Program – Objection to Negative Declaration

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance. As such, the Negative Declaration violates the California Environmental Equality Act (Pub. Resources Code, § 21000 *et seq.*) ("CEQA").

The proposed Ordinance would give the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin) on organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for me and my family, and a loss of productive organic farmland.

Eyes gnats are endemic to San Diego County and their population varies widely from time to time according to numerous variables, most of which are unknown, as with most insects. The little research conducted by the County so far lacks the necessary controls and has been conducted for such a short period of time that no valid conclusions are possible. It is particularly noteworthy in this regard that the number of eye gnats appears to have dropped substantially from last year. Without an understanding of the year to year variation in density and the causes for such variability, there is no scientific basis for any control measures and hence no basis for a Negative Declaration.

One thing that is certain, an eye gnat is not a "vector" and hence should not be subject to control by the County. The County's own website defines vector as "an animal or insect that can carry and pass on a human disease." The definition in Ord. Sec 64.202(f) is similar. These definitions are consistent with the dictionary and scientific meaning of the word. The gnats here not vectors at all but nuisances in and of themselves. No one is complaining that they have caught any

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disease from the gnats, only that they are unpleasant. Yet the Eye Gnat Ordinance proposes to include eye gnats in the definition of "vector" and thus the County seeks to give itself to the power to enter onto property without permission and to close lawful businesses. Specifically with regard to the Escondido/San Pascal Valley eye gnat problem, the County is attempting to expand its authority to regulate a matter otherwise within Escondido and City of San Diego control. As localized nuisances which do not spread disease, the eye gnats in San Pascual Valley are not subject to County regulation.

In addition, the Eye Gnat Ordinance violates CEQA because the Ordinance does not qualify as an exempt project under CEQA Guidelines section 15061(b)(1). The Eye Gnat Ordinance will have a significant impact on agricultural resources because it may result in conversion of farmland to non-agricultural uses by forcing organic farmers to cease operations. The Eye Gnat Ordinance may also significantly impact air quality by requiring pesticide application and may significantly impact biological resources, specifically the Santa Ysabel watershed which drains into the San Dieguito River. Hydrology and water quality may thus be degraded. Further, the public and environment may be exposed to harm from the routine transport, use and/or disposal of hazardous materials, *i.e.* pesticides. A Negative Declaration is obviously improper unless the Ordinance's pesticide provisions are deleted.

The eye gnat problem is real but the Eye Gnat Ordinance is not the solution. It represents an attempt to mollify some residents by sacrificing a few farmers in violation of the law and without any assurance that the sacrifice will bring any relief.

Sincerely,



Erick R. Altona

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A.95

From: Amber Cassen
To: LUEG, DEH-Evegnat
Subject: San Diego County's proposed Eye Gnat Ordinance
Date: Wednesday, June 20, 2012 9:46:03 AM

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

I am writing to request that a full Environmental Impact Report be completed about the Eye Gnat Ordinance Program. The Negative Declaration that was prepared is inadequate and offers no meaningful solutions that keep Organic Standards intact. This is a devastating report and its consequences are equally bad for the large organic farming community located in San Diego County. Organic farmers will be upset over the possible use of pesticides that will be required just to calm a few households not educated about the harms of trying to control pests by poisoning them with pesticides. Ultimately the pests build up resistance and newer, stronger pesticides will be required. In the mean time organic farming in San Diego County will be done. What will be the economic results to the county by these short-sighted measures. How many jobs will be lost?

The harms of pesticides are only now being recognized and are found to be extremely harmful to the soil, to the air and ground water and to the ocean. I have not even begun to mention all the human health problems related to high pesticide residues on our foods and in our environment. Have the Supervisors been paid off by the chemical companies who are trying to destroy the organic movement? Or maybe the homeowners are contributing to the re-election campaigns of the Supervisors?

If this is passed in its current form, this ordinance would:

1. Force organic farms to spray pesticides whenever an unspecified number of complaints from neighbors are received. This strips the farm of its organic certification and affects the health of surrounding populations.
2. Give one person complete control over the (previously) organic farm and its operations. The Director of Vector Control has full power to seek relief from applicable, validated and practicable control measures. This can be achieved by ordering a fallow period, changing a farmer's crop selection or by ordering the implementation of a "barrier" crop.
3. Reduce farmable acreage by possibly mandating the use of "barrier" crops, which would have a negative financial impact on farmers.
4. Shut organic farms down during peak growing season, possibly for weeks during the summer, the peak growing season. This fallow period could effectively close most organic farms in San Diego County.
5. Target organic farms without a scientific basis by solely acting on neighbor complaints, and the decision of a single director responding to these complaints. The director has the authority to override input from scientific or agricultural agencies knowledgeable about organic farming.

The solution is to give the farms sufficient time to implement the voluntary community wide measures and reject the ordinance in its current punitive form. Local supermarkets, Whole Foods, People's Organic Co-op and Jimbo's are promoting organics and are against this ordinance.

Sincerely,

Amber Cassen
3522 Corte Mora
Carlsbad, CA 92009

A.96

From: Stacey Hard
To: LUEG, DEH-Evegnat
Subject: Request for Full impact report
Date: Tuesday, June 19, 2012 9:49:20 AM

Hello, I am writing to request a full environmental impact report be provided for the Eye Gnat ordinance proposal. I am very concerned of the impact spraying all areas of San Diego county will have on my family and my ability to buy local organic fruits and vegetables. Thank you for taking the time to do the proper and appropriate research prior to rushing into any decisions on this matter. Thank you,
Stacey Hard, 597 Holly lane, Vista, CA 92084 760-809-9722

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A.97

From: Daniel Osman
To: LUEG, DEH-Evegnat
Cc: Daniel Osman
Subject: Eye Gnat Ordinance and Program -- Negative Declaration
Date: Tuesday, June 19, 2012 2:17:52 PM

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance Program. The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch. Spraying pesticides on an organic farm will mean not only the end of Be Wise Ranch's organic status, and thus destruction of a local business, but also an end to the organic produce the farm produces for my family. Such a decision should not be taken lightly. Please consider the significant impacts to the environment, to business, and to citizen opportunity and access to organic produce that will be created by the ordinance. Please investigate a pesticide-free alternative.

Thank you for your consideration,

Daniel Alan Osman

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A.98

From: [Karen Andersen](#)
To: [LUEG, DEH-Eyegnat](#)
Cc: [Cox, Greg](#); [Slater, Pam](#); [Ron-Roberts](#); [Jacob, Dianne](#); [Horn, Bill](#); carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; [Ida](#); [Bob Curtin](#); [Be Wise Ranch](#)
Subject: Eye Gnat Ordinance & Program- Negative Declaration
Date: Wednesday, June 20, 2012 9:49:26 AM

Hello Mr. Miller,

I am writing to vehemently request a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance & Program. The Negative Declaration that was previously prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by this ordinance.

I cannot begin to fathom the cost and loss that will be brought upon small businesses and farms. Not the mention the cost to me and my family as we utilize the produce and rely on them for fresh organic pesticide free foods.

Spraying pesticides in our community impacts not only the plants, but the animals and people as well. The San Pasqual Valley is an open park and agriculture preserve that supports many species. Spraying pesticides would allow poison to enter the food chain; which relates to not only the animals of in the area, but the people as well. Your environmental document gives no analysis to these impacts. I am concerned not only for the health of my family but the local ecosystem as well. We are only as strong as our lowest member on the food chain. I want to know what these impacts will have!

One other concern I'd like to point out, is the rush of this ordinance. The county is rushing this without environmental review. Considering that the numbers of Eye Gnats are down from previous years, the County can afford to give this proper time before prematurely implementing regulations that will hurt not only the people, plants and animals that depend on this poison free zone, but our local businesses as well.

Please consider the impacts to the environment and to the health of my family that will be created by your ordinance. I am asking you to do the right thing and work on a pesticide free-alternative to this ordinance.

Thank you for your time!

Karen Andersen

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A.99

From: scotta1124@aol.com
To: [LUEG, DEH-Eyegnat](#)
Cc: [Slater, Pam](#)
Subject: Eye Gnat Ordinance Review
Date: Tuesday, June 19, 2012 2:21:13 PM

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Re: Eye Gnat Ordinance

Dear Mr. Miller

I am a CSA customer of Be Wise Ranch and have heard of the potential spraying for eye gnats. I strongly disagree with spraying any pesticides on crops/fields certified or not certified organic. The health and environmental issues are obvious. The cost may not be. But I for one would no longer buy produce grown in any area where there is spraying.

I believe the spraying is premature and growers need to be given more time to show they are alleviating the problem naturally.

Sincerely,
Kathy Aldern

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A.100

June 18th 2012

From:
1439 Leland Way
Escondido, Ca
92026

To: County of San Diego
Department of Environmental Health
Vector Control
re Ey Gnat Ordinance ~~and~~ Program

To Whom it concerns:

Thank you for your notices in regard to the proposed ordinance. I am a resident school teacher who has over the years carefully studied the environmental issues surrounding agricultural chemicals - specifically pesticides - here and in Kern County.

How - in good scientific conscience, in honest service to the "best interests of public health", and with awareness of bureaucratic pitfalls (human weakness) - can this ordinance in any way permit the authorization/requirement of the "five conventional pesticides: Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin?"

This is unnecessary, a travesty of the Department's responsibilities to its public and the wider long-term

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interests of our County's growing reputation as a source of genuinely "organic" produce.

As your experienced senior staff know well, any permitting, for whatever cited reason, will be mis-used. The result immediately of such an ordinance will taint the confidence of consumers in our County's farms' "organic" certifications.

Why would our Environmental Health Department want to do this to an industry which is addressing beneficially - and essentially - at great professional and personal commitment over many years, the health of the general public? I urge you to resist the pressures that would include such chemicals in this ordinance.

Sincerely,

M. A. Marek
1439 Leland Way
Escondido, Ca 92026

From: Kim Knox [kim@kk2.com]
Sent: Friday, June 22, 2012 7:00 AM
To: LUEG, DEH-Eyegnat
Subject: Negative Declaration

Please prepare a full Environmental Impact Report for the proposed Eye Gnat Ordinance. The Negative Declaration is inadequate and may mean pesticides will be sprayed on the crops at Be Wise Ranch, where my family gets our organic produce. They've been a responsible member of the community for many years and deserve a chance to handle the pest problem without being put out of business.] 1

-Kim

A.102

From: [Laura Hunter](#)
To: [LUEG, DEH-Eyegnat](#)
Subject: Eye gnat comment letter- EIR must be done
Date: Tuesday, June 19, 2012 3:10:55 PM
Attachments: [eye gnat eir.pdf](#)

Please find attached our comment letter on the eye gnat ND.

Thanks

Laura Hunter

(760) 740-9405

earthlover@sbcglobal.net

Laura Hunter and Ron Forster
744 Quiet Hills Farm Road Escondido CA 92029 760-740-9405 earthlover@sbcglobal.net

June 19, 2012

County Board of Supervisors
County Administration Building
1600 Pacific Highway
San Diego, CA 92101

Re: Request for Require Full EIR for Eye Gnat Ordinance

Dear Chairman Roberts and Supervisors:

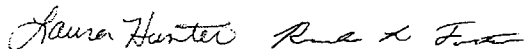
We live in North County near Lake Hodges and have previously submitted comments on this issue. **We strongly oppose the Negative Declaration that has been proposed by the staff.** There are countless reasons why this ordinance, as drafted, could have very significant environmental impacts. We support the comments outlined in the letter from Environmental Health Coalition and others who have raised the issues related to the pesticide use. The impacts to human and environmental health are significant and it is even more egregious in this case since the use is unnecessary and would have a huge negative economic impact on one of North County's most valuable businesses.

This ordinance should be either re-written to delete the designation of eye-gnats as vectors and require non-chemical BMPs or the County needs to do an environmental impact report to analyze alternatives (including the no project alternative) and propose adequate mitigations. Further, these are VERY dangerous and toxic materials and will have impacts on the local wildlife, water quality, and could contaminate local human residents and trail users through pesticide drift. We also have many vulnerable endangered birds and amphibians in the river park that are highly susceptible to pesticide exposure. None of these impacts have been analyzed or mitigated and must be for your action to be legally done.

Frankly, we know that government do better than just randomly spray toxic chemicals on our problems and hope they go away. The County should seize this opportunity to work together with Be Wise Ranch and the San Dieguito River Park to develop pesticide free solutions to this issue.

Please require an environmental impact report and alternatives analysis for this proposed ordinance. If you don't have that information, it will be impossible for you to make an informed decision.

Sincerely,



Laura Hunter and Ron Forster

cc.eyegnat@sdcounty.ca.gov

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

A.103

From: [mkl](#)
To: [LUEG, DEH-Evegnet](#)
Cc: [Teri Wyness](#)
Subject: Eye Gnat Ordinance - Negative Declaration
Date: Tuesday, June 19, 2012 3:21:06 PM

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Mr. Miller,

This e-mail expresses our concern regarding the proposed Eye Gnat Ordinance - Negative Declaration and the potential to require chemical pesticide application in the San Pasqual agriculture and open space park. Use of chemical pesticides in the preserve would end organic farming activity, at least, and could end the use of the valley as any kind of preserve.

As participants in the Bee Wise Ranch Organic Farm cooperative, we support local organic growers and enjoy the quality of food that such an activity provides.

We do not support required applications of chemical pesticides in San Pasqual Valley or anywhere in San Diego County where organic farming is in practice.

We are concerned that a long standing organic farming business will be forced to close and a long standing preserve may be irreparably damaged due to this proposed ordinance.

Sincerely

Michael Lasiter
Teri Wyness

15311 San Moritz
Poway, CA 92064

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A.104

From: sophie.chen
To: LUEG, DEH-Evegnat
Subject: Eye Gnat Ordinance and Program- Negative Declaration
Date: Tuesday, June 19, 2012 3:54:19 PM

Dear Mr. Miller,

The Negative Declaration is inadequate and provides minimum analysis of important environment impacts as a result of the ordinance.

As a result of the proposed ordinance, farms like Be Wise Ranch will lose their organic status and many families include myself will lose a reliable and affordable source of fresh, healthy vegetables and fruits on their tables. It may also force these farms out of business and farmers lose their jobs. Beyond all these, it may directly affect the ecosystem in the San Pasqual Valley.

Also Be wise ranch has listened to the opinion of neighbor residents and improved their way of farm to reduce the eye gnat problem. Eye gnat at the golf course this year are way down from years ago. The county should wait to see the results before making a decision that will affect a local business and people rely on this business.

Please consider the significant impacts to the environment and people depending on the local business. Please do the right thing and work with be wise ranch on a pesticide-free alternative to this ordinance.

Thanks for your attention,

Sophie Chen

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A.105

From: kbelo@cox.net
To: [LUEG, DEH-Evegnat](#)
Cc: [Cox, Greg](#); [Slater, Pam](#); [Ron-Roberts](#); [Jacob, Dianne](#); [Horn, Bill](#); carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance
Date: Tuesday, June 19, 2012 4:12:05 PM
Attachments: [evegnat2.doc](#)

Mr. Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller,

I am writing to you to express my **strong opposition** to the proposed eye gnat ordinance. This ordinance will allow the use of pesticides on the Be Wise Organic Farm. I am currently a member of the CSA program on the Be Wise Farm. The Community Supported Agriculture program provides my family with fresh, organically grown produce. The eye gnat ordinance will effectively destroy the organic status of the Be Wise Farm and directly impact an important food source, not only for myself and my family, but for many other local residents.

I believe a full environmental impact report is warranted for the eye gnat ordinance. The negative declaration is inadequate and does not provide a responsible assessment of the wide-ranging implications of this ordinance.

Recently, the City of San Diego changed their ordinance concerning backyard farming, which includes an allowance for micro-flocks of chickens, goats and bee hives. This positive movement towards locally grown and organic produce is rapidly gaining momentum, but it will also attract nuisance pests, like the eye gnat. Homeowners and “urban farmers” who are composting, and dealing with animal feed, water and waste will need new ways to control these pests. We will not be able to chemically spray our way out of these common problems.

Be Wise Ranch is an experienced and respected organic farm. These large organic farms are the best way to study, learn, and develop new ways of controlling pests, without chemicals. The information obtained can then be applied to the smaller backyard farmer to the benefit of everyone. As a beekeeper, I am especially sensitive to the use of pesticides and the devastating impact on our bee population. Without bees, we will have no food, organic or otherwise. The continued use of pesticides just perpetuates these harmful effects.

Again, I reiterate my belief that a full environmental impact report is a necessity in order to fully understand and respond appropriately to the eye gnat nuisance.

Sincerely,

Katherine Belo

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Bonita, CA 91902

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A.106

From: laura@lauramurphy.net
To: [LUFG DEH-Eyegnat](#)
Subject: eye nats
Date: Tuesday, June 19, 2012 5:34:51 PM

Dear Jack Miller,

I wanted to write you to let you know I am opposed to any pesticide spraying for eye gnats. While I totally understand the issue, I feel strongly that organic farms, such as Be Wise, where I choose to purchase locally for my family be able to maintain their organic status.

I love getting to purchase produce from within San Diego County and because eating food free from pesticides is very important to me, I choose organic. Please don't take that away.

It is my request that a full environmental study be done before the government regulates the spraying of pesticides in San Diego County and San Pasqual Valley and that more time is given to see the impact of the natural steps Be Wise has taken already.

Thank you for considering.

Enjoy your day,
Laura Murphy
<http://www.lauramurphy.net>
(510) 332-0842

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A.107

From: Nikki List
To: LUEG, DEH-Eyeonot
Subject: A plea to not proceed with eye gnat ordinance and program.
Date: Tuesday, June 19, 2012 5:50:10 PM

Jack Miller
Dept of Environmental Health
5570 Overland Ave
Suite 102
San Diego, Ca 92123

RE: Eye Gnat Ordinance and Program - Negative Declaration

Dr. Mr. Miller:

I am very surprised that the proposed eye gnat ordinance and program was put in to place without regard to organic farming and the community's health. Especially in this day and age, where health is important and where it has been proven that environmental factors play a big role in many illnesses, I am truly shocked that this is even being suggested. Myself and a large group of employees here at my work are members of the Be Wise Ranch CSA, which delivers organic produce to various areas in San Diego. We would ALL be extremely upset if these pesticides were used on our families produce. And in this economy where small businesses struggle, the thought of putting a local organic grower out of business is just criminal. Organic farming is the direction we should look towards and support, and not destroy.

This is why I am writing you to request that a Full Environmental Impact Report be prepared. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of the effects this proposed ordinance would have on the environment. To not do this would be irresponsible and will impact the plants and animals in the San Pasqual Valley. The San Pasqual Valley is a CITY open space park and agricultural preserve that supports endangered and threatened species. Be Wise Ranch works harmoniously with the protection of these species because of its use of natural methods to grow crops and control pests. You cannot allow spraying of pesticides that would invade this area and enter the food chain. Your environmental document gives no analysis to these impacts. I am concerned about my family's health, as well as the community's health, and you should be too.

Please consider your hasty response to a problem that is showing signs of improvement and not rush through a dangerous ordinance without properly investigating. The health of the community and the ecosystem depends on you making an informed decision by first getting all the facts. Please work with Be Wise Ranch on a pesticide-free alternative to this ordinance, as it seems what they are doing is working.

Thank you for your time and consideration in this very important matter.

Nikki List

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A.108

From: Christina Roman
To: LUEG, DEH-EyeGnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Re: Eye Gnat Ordinance and Program - Negative Declaration
Date: Tuesday, June 19, 2012 6:00:00 PM

Dear Mr. Miller,

I am writing as a long-time Be Wise member (and 20 year resident of San Diego County) to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

Because the proposed ordinance gives the County the authority to spray pesticides on organic crops, this will mean the end of Be Wise Ranch's organic status...an end to the healthy fresh produce the farm provides for me and my family. This is truly a tragic precedent to set here in San Diego County where residents are keenly aware of the importance of both buying local to support our farmers and to eat healthy to protect our health.

A personal story: One year ago, our 19 year old daughter returned home from college with extreme low energy and undiagnosable health issues. We spent thousands of dollars (not covered by insurance) driving all the way to Palm Springs weekly, then monthly for the past year to consult and work with a specialist. While his treatments were effective, one of the most important things we learned was the importance of treating "food as medicine" as Hippocrates suggested so many years ago. We learned that one of her central problems was her body's inability to detoxify appropriately (true for so many of us w/chronic health conditions). When we changed her diet to one high in fresh, organic fruits and vegetables, her health blossomed and her energy returned.

As a result of her experience, she chose to leave the Honors program at the private school she was attending in the Northwest, changed her major to Ecology and has spent the past year interning for the San Elijo Lagoon Conservancy and taking science classes at Mira Costa College. (She won first place at the UC Irvine Honors Conference--first time a Mira Costa student has ever won--recently for her academic poster on an anthropology topic). She plans to transfer to UCSD as an Ecology major in a year. Her energy has skyrocketed and she now works out intensely daily.

Needless to say, none of this would have been possible without all we have learned about the healing power of organic food. Be Wise makes that possible and affordable for us. So I am particularly concerned that the spraying of pesticides will impact the plants and animals in the San Pasqual Valley. Your document reviews County policies, but the impacts to Be Wise Ranch and the Valley are in the City of San Diego. Your document also gives no analysis to the impact of spraying pesticides that would enter the food chain of animals in the area. I am concerned about the health of my family and local ecosystem and want to know what these impacts will be.

I also don't understand why the County is rushing this ordinance without proper environmental review. Since Be Wise has already taken action to reduce eye gnats and it seems to be working, why doesn't the County wait to see the results before enacting more regulations that negatively impact our local economy?

Please consider the significant impacts to the environment and to the health of my family--and all of us here in San Diego County who are so passionate about using food as medicine--and do the right thing. Work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you,

Chris Roman

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A.109

From: Mary Jo Trojnacki
To: LUEG, DEH-Evegnat
Cc: peugh@sandiegoaudubon.org; sdaudubon@sandiegoaudubon.org; dbobertz@sdrp.org; shawna@sdrp.org; Jacob, Dianne; Slater, Pam; Cox, Greg; Ron-Roberts; Horn, Bill; carldemaio@sandiego.gov
Subject: Eye Gnat Program and Ordinance
Date: Tuesday, June 19, 2012 6:02:27 PM

Dear Jack Miller, Elizabeth Pozzebon and San Diego governing board representatives,

I have recently been made aware of the current proposal in regards to the Eye Gnat Program and Ordinance, which would give the County the authority to order the spraying of toxic pesticides. I wish to submit the following comments, as it is noted that they must be received no later than, June 20th, 2012.

The recommended pesticides are clearly listed to be toxic to birds, bees, wild mammals, aquatic invertebrates, etc., in addition to containing hazardous statements pertaining to standing water, ground water and waterbodies! I am requesting that a FULL Environmental Impact Report be conducted. The Negative Declaration that was prepared seems incomplete as to the environmental impacts that will be caused by the toxic pesticides included as part of this ordinance.

It is appalling to think that the San Diego governing board members and the general public, who's efforts to create, support and protect the MSCP and San Dieguito River Park, would be allowed to be so ridiculed by such an ordinance. I want to really emphasize the negative impact on bees (which has been of great concern countrywide *and* worldwide), as well as threatened species like the Arroyo Toad, the Least Bell's Vireo, and California *Gnatcatcher*! (Now that would be quite the headline: "San Diego Supports *Killing Bees*" or perhaps "San Diego Sprays *Gnatcatchers* in Effort to Kill *Gnats*"). Haven't we yet learned of the consequences to such actions? Please...do no harm!

I have also been informed that one of the targeted organic farms, Be Wise Ranch, has already implemented non-toxic controls. What environmental reviews have been completed, that show that these actions are not working? In these difficult economic times, why on earth, would the County support an ordinance that would hurt and perhaps cause to shut down, these organic farms? What of the impact on the many thousands of families, and the local businesses who support these growers, if in fact they do shut down their farms due to lack of certification?

Again, I reiterate my genuine request that a complete and FULL Environmental Impact Report be prepared. Seems as though Be Wise Ranch is at least more than willing to work with pesticide-free alternatives to help resolve this issue. Will you also work along with them, and save those immediate environments from additional harm?

With Sincerity,
MJ

A. 110

From: edbennett@cox.net
To: [LUEG, DEH-Evegnat](#)
Subject: Propose ordinance
Date: Tuesday, June 19, 2012 6:25:58 PM

To whom it may concern:

I urge you to pursue a full environmental impact report regarding the County's proposed Eye Gnat Ordinance and Program.

As a long-time supporter of organic agriculture, particularly here in North County, I rely on local sources of pesticide-free produce for my own health and that of my family. I have been a customer of Be Wise Ranch for many years, and consider their operation to be a great asset to the community by providing fresh, uncontaminated food. The ranch owners are should be allowed adequate time to implement control methods which will not have a negative impact on the environment.

The introduction of pesticides and other chemicals, as opposed to more natural and sustainable methods, would have a negative impact on the soil, the quality of underground water, and animal and bird life. Long-term consequences of exposure to these chemicals on human beings, particularly small children, are becoming well-documented.

This matter is too important to be decided with a hasty decision which, once made, may have negative effects in the future.

Your thoughtful consideration of this matter will be appreciated.

Sincerely,
Ed Bennett

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A.111

From: Cathy Myers
To: LUEG, DEH-EyeGnat
Subject: eye gnat ordinance - negative declaration
Date: Tuesday, June 19, 2012 8:20:52 PM

To whom it may concern (and I believe this concerns everyone who eats food in San Diego County),

I am writing to request that a full environmental impact report be prepared for the county's proposed eye gnat ordinance and program. The negative declaration is inadequate and provides no meaningful analysis of impacts. Who came up with this? Did they even read the ordinance? How can the imposed spraying of Malathion cause no environmental impact? It's a cancer causing agent!

I am concerned that the spraying of pesticides will impact the people of the San Pasqual Valley. Be Wise Ranch is in an agricultural preserve. That means that the spraying of pesticides will affect far more than just Be Wise Ranch. Threatened species such as the Arroyo Toad, the Least Bell Vireo and the California Gnatcatcher are at risk. I am concerned about the health of my family and the local ecosystem. Please do a full analysis before pushing through any ill conceived ordinances.

Proper environmental review is crucial. Why doesn't the county wait to see the results of what Be Wise is doing before enacting more regulations?

Thank you for your attention on this matter.

Cathy Barger

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A.112

From: [Armand Aguirre](#)
To: [LUEG, DEH-Eyegnat](#)
Cc: carldemaio@sandiego.gov; [Cox, Greg](#); [Slater, Pam](#); [Ron-Roberts](#); [Jacob, Dianne](#); [Horn, Bill](#); Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program Negative Declaration
Date: Tuesday, June 19, 2012 8:49:00 PM

Dear Mr. Miller,

I was recently notified that the County of San Diego intends to adopt a Negative Declaration regarding the proposed Eye Gnat Ordinance and bypass a full Environmental Impact Study. I am extremely concerned that normal procedure can be circumvented by such an uninformed action. The Negative Declaration that was hastily prepared is inadequate and does not take into consideration the serious environmental impacts that will result from the implementation of the ordinance as currently proposed.

The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch, and thus effectively orders the end of Be Wise Ranch's existence as a supplier of fresh, organic produce for me, my family, and hundreds, if not thousands, of other health-conscious consumers. I also cannot understand how the County can order the spraying of pesticides in the San Pasqual Valley, which is a City open space park and agricultural preserve. Numerous endangered and threatened species of animals live in the valley and Be Wise Ranch's organic farming methods are the only possible way to protect these species. Ignoring such impacts seems to be unethical and possibly illegal.

The apparent urgency in sidestepping an Environmental Impact Study also leads me to suspect a foregone determination by the County to close the Ranch. From all reports that I have heard, the measures that Be Wise has undertaken in the last months have shown significant success in reducing the eye gnat levels. I would think that the County would want to wait to see the results of these eye gnat abatement measures before passing such a draconian ordinance.

Please try to view the Be Wise Ranch as the treasure that it is and consider the significant impacts to the environment and the health of so many families that will be created by your ordinance. Please work *with* Be Wise in the spirit of cooperation to find a pesticide-free alternative to this ordinance.

Thank you,
Armand Aguirre
Be Wise CSA Member

A.113

From: mkiehl@gmail.com
To: [LUEG, DEH-Eyegnat](#)
Subject: Oppose the Negative Declaration and Request a full Environmental Impact Report for the San Diego proposed Eye Gnat Ordinance and Program!
Date: Tuesday, June 19, 2012 10:10:53 PM

Martha Kiehl
12751 Gateway Park Road, Apt 307
Poway, CA 92064-2063

June 20, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

Please do not go forward with this Negative Impact thing without a thorough environmental impact statement if that's what it takes to bring you people to your senses.

Today, June 19, there was a news blurb on CNN about pesticides on food: It discussed how the FDA had tested non-organically grown produce and found pesticide residue on ALL WASHED fruits and vegetables. There was considerable discussion on the subject (i.e. the best and worst foods with pesticide potential) but the bottom line was that to avoid pesticides, eat organic food!

It's too bad that eye gnats interfere with barbequeing, soccer games and rounds of golf but HELLO! ... how big a deal is that compared to the quality of our food supply and the lifelong health impact when health costs are a topic of MAJOR political contention these days.

There are other ways to deal with the problem and the organic farmers are working to combat the varmints. This site describes various traps that anyone can make to catch them:
http://www.sdcounty.ca.gov/deh/pests/pdf/Eye_Gnats/eye_gnat_trap_instructions.pdf

For Heaven's sake, it should be obvious to everyone that a clean food supply trumps a few recreational activities so PLEASE don't go jumping into drastic measures without more careful thought AND a complete study of the unintended consequences that can result from rash action.

I'm almost 93 years old and can figure this out. Why can't you?? For Pete's sake....PAY ATTENTION before it's too late!

Sincerely,

Martha Kiehl
8586759447

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A.114

From: [Rose Aguirre](#)
To: [LUEG, DEH-Eyegnat](#)
Cc: [carldemaio@sandiego.gov](#); [Cox, Greg](#); [Slater, Pam](#); [Roberts, Ron](#); [Jacob, Dianne](#); [Horn, Bill](#); [Steve@stevedanon.com](#); [campaign@daverobertsforsupervisor.com](#)
Subject: Eye Gnat Ordinance and Program Negative Declaration
Date: Tuesday, June 19, 2012 10:20:34 PM

Dear Mr. Miller,

I was recently notified that the County of San Diego intends to adopt a Negative Declaration regarding the proposed Eye Gnat Ordinance and bypass a full Environmental Impact Study. I am extremely concerned that normal procedure can be circumvented by such an uninformed action. The Negative Declaration that was hastily prepared is inadequate and does not take into consideration the serious environmental impacts that will result from the implementation of the ordinance as currently proposed.

The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch, and thus effectively orders the end of Be Wise Ranch's existence as a supplier of fresh, organic produce for me, my family, and hundreds, if not thousands, of other health-conscious consumers. I also cannot understand how the County can order the spraying of pesticides in the San Pasqual Valley, which is a City open space park and agricultural preserve. Numerous endangered and threatened species of animals live in the valley and Be Wise Ranch's organic farming methods are the only possible way to protect these species. Ignoring such impacts seems to be unethical and possibly illegal.

The apparent urgency in sidestepping an Environmental Impact Study also leads me to suspect a foregone determination by the County to close the Ranch. From all reports that I have heard, the measures that Be Wise has undertaken in the last months have shown significant success in reducing the eye gnat levels. I would think that the County would want to wait to see the results of these eye gnat abatement measures before passing such a draconian ordinance.

Please try to view the Be Wise Ranch as the treasure that it is and consider the significant impacts to the environment and the health of so many families that will be created by your ordinance. Please work *with* Be Wise in the spirit of cooperation to find a pesticide-free alternative to this ordinance.

Thank you,
Rose Aguirre
Be Wise CSA Member

A.115

From: Janice Booth
To: LUFG, DEH-Evegnat
Subject: About the eye gnat ordinance
Date: Tuesday, June 19, 2012 10:24:59 PM

To whom it may concern:

I think it is wonderful that we, in California, with all our sunshine, are so fortunate to have small organic farms, that we can get beautiful, wonderful tasting, just picked, vegetables ! I am very upset that this eye gnat ordinance might totally eliminate many of these farms, because of a small bug that has been here before most these farms existed.

I plead with you to reconsider this ordinance and how it will affect more jobs, and keeping our small farms alive here in California. I like buying locally, especially from our community.

Besides knowing I am getting top quality product!

Thank you for reconsidering this ordinance.

Sincerely, Janice Booth

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A.116

From: Marie Skillman
To: LUFG, DEH-Evegnat
Subject: No on Eye Gnat Ordinance
Date: Tuesday, June 19, 2012 10:37:35 PM

Please do not implement the proposed Eye Gnat Ordinance.

If implemented, it will force organic farmers to use chemical sprays - thus rendering them unable to label their crops "organic". These local businesses have done a great deal to make San Diego a nationally recognized food paradise.

Organic farmers are participating in legitimate, scientific research to mitigate the problem and are assembling the necessary traps to implement proven measures to control eye gnat populations that don't include any of the restrictions the ordinance requires.

We ask that the Board of Supervisors give organic farms the time they need to implement these voluntary, community-wide measures and reject the ordinance in its current, punitive form.

Thank you.

David and Marie Skillman
3065 Elm Street
San Diego, CA 92102

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A.117

From: mdabfab23@aol.com
To: [LUEG, DEH-Eyegnat](mailto:LUEG.DEH-Eyegnat)
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; Fabmrs02@aol.com
Subject: RE: Eye Gnat Ordinance and Program - Negative Declaration ICO Be Wise Ranch
Date: Tuesday, June 19, 2012 11:10:32 PM

Dear Mr. Miller,

I am writing to voice my concern on behalf of the Be Wise Ranch. It was recently brought to my attention that the San Diego County Department of Environmental Health along with the

San Diego County Board of Supervisors are proposing to adopt a Negative Declaration and bypass a full environmental impact study on the Eye Gnat Ordinance and Program.

The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of the important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order spraying of pesticides to include Acephate, Malathion, Diflubenzuron, Cryomazine, and Cyfluthrin on the organic crops

grown at Be Wise Ranch. My wife and I have are consumers of the Be Wise Ranch CSA, which provides fresh vegetables and produce to us at a pick-up site in my Neighborhood. **We**

are concerned that your actions will mean the end of Be Wise Ranch's organic status, an end the healthy, fresh produce the farm provides for me and my family, and the loss of productive

organic farmland and service to San Diego County. Your actions or inactions by color of "law" is nothing short of Tyranny over who you claim to govern and protect. Given your past decisions to

inject a deadly poison called Fluoride into our drinking water; we hold little hope you will reconsider what you are doing to health and commerce in San Diego County. The adoption of a Negative

Declaration and bypassing of a full environmental impact study pose serious impact to the environment and to the health of my family. Rushing this ordinance without proper environmental review

may leave consumers of Be Wise Ranch's produce with no other option than to consider a class action lawsuit as this mater moves forward? We ask that you fully consider our health concerns

and future ramifications your actions will have upon the county and consumers of Be Wise Ranch's produce if you decide to move forward without a full environmental impact study.

Very Respectfully,
Mr. David Allen Begy USN RET
Mrs. France Begy
San Carlos - San Diego

Cc:

Supervisor Greg Cox
Supervisor Pam Slater-Price
Supervisor Ron Roberts
Supervisor Dianne Jacob

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Supervisor Bill Horn
Councilman Carl DeMaio
Steve Danon
Dave Roberts

A.118

From: [Jane Smitham](#)
To: [LUEG, DEH-Evegnat](#)
Subject: Eye Gnat Ordinance
Date: Wednesday, June 20, 2012 3:06:45 AM
Attachments: [Eye Gnat Ordinance.doc](#)
[Eye Gnat Ordinance.docx](#)

Via E-mail: eyegnat@sdcounty.ca.gov

Jack Miller

Department of Environmental Health

5570 Overland Avenue, Suite 102

San Diego, CA 92123

RE: Eye Gnat Ordinance and Program -- Negative Declaration

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared for the proposal is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The current proposed ordinance will end Be Wise Ranch's organic status, an industry that provides my family, and my community with a safe food source. I am entirely uncomfortable with the idea that the County impose upon organic farming the spraying of unsafe pesticides on our food source. These pesticides include Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin, all of which are associated with both known and as yet unknown dangers to human health. Furthermore, they destroy the ecosystem of pesticide free farming. When pesticides destroy the ecosystem, this in turn creates much greater problems, including the introduction of pesticide resistant pests may take up residence in a crop where a natural ecosystem could have kept them in check.

Organic farming is a niche industry with constantly increasing consumer demand. By insisting on the precipitous actions of pushing through this ordinance without first obtaining a full environmental impact report will result in the decreased value of life in San Diego and a decrease in the prosperity of a niche industry.

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Safe and cost-effective solutions to the Eye Gnat situation are available through a full Environmental Impact Report. Investment in a full Environmental Impact Report is a minor investment that frees the city of its citizen's criticism because it shows due diligence. Furthermore, the long term cost of this proposed ordinance program to the citizens of San Diego and to the County may be easily offset by investment in a full Environmental Impact Report.

I urge you to put as a first priority the health of all San Diego's citizens and obtain a full Environmental Impact Report with a detailed analysis that will allow the city to select a safe alternative to spraying.

Thank you,

Jane Smtiham, San Diego Citizen

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Jane Smitham
Mobile. 858-922-0002
jsmitham@gmail.com
jsmitham@ucsd.edu

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continue

A.119

From: Leslee Hall
To: LUEG, DFH-Evegnat
Subject: San Diego County's proposed Eye Gnat Ordinance
Date: Wednesday, June 20, 2012 6:32:57 AM

Dear Sirs,
Please reconsider your tentative Negative Declaration and adopt the full environmental impact study regarding the proposed Eye Gnat Ordinance.

I have enjoyed the organic produce from Be Wise Ranch for several years now. As a community, we need to protect our environment from chemicals. The eye gnat issue is not solely created by the ranch and needs to be worked on as an entire community. Using chemicals will send the runoff into our oceans which will have an impact far more harmful than tolerating the gnat for a short spell.

There are solutions that Be Wise Ranch is trying and continues to work toward a remedy. Please allow the time for a complete study. The quick answer of pesticides is not a proper long term solution. The use of chemicals will destroy the organic farm and put them out of business. In this harsh economy, we do not need to destroy another business in San Diego County.

Thank you,
Leslee Hall
3071 Massasoit Avenue,
San Diego, Ca. 92117

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A.120

From: Mary Sharp
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat Ordinance and Program
Date: Wednesday, June 20, 2012 7:56:23 AM

I have read draft eye gnat ordinance and the reports on the studies of 2009-2011. As a resident of South Escondido, I am particularly disturbed by addition of SEC. 64.403 paragraph (f):

Except as a last resort, the Director may not order a commercial organic grower to apply chemical controls to organic crops or fields for the purpose of controlling eye gnats if the use of such chemical controls as ordered would cause the grower to lose certification as an organic grower for the affected field or crop.

The pesticide summary states that acephate is toxic to birds, wild mammals, and aquatic invertebrates and marine/estuarine organisms, and that malathion is extremely toxic to bees. There are parks, schools and reservoir in the area that could easily be affected by the drift and runoff from these chemicals.

The addition of the vague phrase, except as a last resort, in several places in the ordinance, is objectionable. It is not apparent what constitutes a last resort. This phrase needs to be removed or clarified.

Respectfully,

Mary Sharp

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A.121

From: Matt.Pawluk@waters.com
To: [Cox, Greg](#); [Slater, Pam](#); [Ron-Roberts](#); [Jacob, Dianne](#); [Horn, Bill](#); caridemajo@saniego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; [LUEG, DEH-Evegnat](#)
Subject: Be Wise Ranch
Date: Wednesday, June 20, 2012 8:22:27 AM

Please do not require that Be Wise spray their plants with pesticide, making their products less than they are today. We have been buying organic fruits and vegetables from Be Wise through their CSA program for years and are so happy to have a local farm that does such good work.

Thank you,

Matt Pawluk
Senior Field Service Engineer - San Diego
Waters Corporation
1-800-252-4752 Ext. 6237

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A.122

From: Sandra Smitham
To: LUEG, DEH-Evegnat
Subject: Re: Organic Farming in San Diego
Date: Wednesday, June 20, 2012 10:20:16 AM

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, Ca. 92123

Dear Mr. Miller,

I am sending this petition Re: Eye Gnat Ordinance and Program-Negative Declaration

I concur with Jane Smitham's letter to you.

Chemical pesticides are a enormous hazard to our environment, citizens and to organic farming in San Diego.

I have seen the results of chemical pesticides spraying in communities and the high impact of health circumstances such as, allergies, cancer and death resulting from the use of a variety of chemicals that have since been banned.

So, please lets approach this with the utmost sanity and intelligence and recognize the harm and danger that pesticides of all types can cause.

Sincerely yours,

Sandra Smitham, Citizen of San Diego

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A.123

From: BettyJo Keenan
To: LUFG, DFH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance - Negative Declaration and Program
Date: Wednesday, June 20, 2012 10:26:51 AM
Attachments: letter for Be Wise Ranch 6-20.docx

June 20, 2012

Robert and Elizabeth Keenan

1617 Joshua Tree Lane

Fallbrook, CA 92028

Jack Miller

Department of Environmental Health

5570 Overland Avenue, Suite 102

San Diego, CA 92123

Delivered via email

Cc: County Supervisors and candidates

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller,

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of impact that the ordinance will have on the environment.

The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Disflubenzuron, Cyromazine, and Cyfluthrin) on the organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status; an end to the healthy, fresh produce the farm provides for our family; and a loss of productive organic farmland. We are currently members of the Be Wise Ranch CSA, which provides fresh

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fruit and vegetables to us from the ranch.

We are further concerned about the impact that the spraying of pesticides will have on the plants and animals in the San Pasqual Valley. Your document looks a lot County policies, but environmental impact will also be on City of San Diego. The San Pasqual Valley, where Be Wise Ranch is located, is a City open space park and agricultural preserve, supporting endangered and threatened species like the Arroyo Toad, the Least Bell's Vireo, and the California Gnatcatcher. Be Wise Ranch's use of organic farming methods is in harmony with the protection of these species because it uses natural methods to grow crops and control pests. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in the area. Your environmental document gives no analysis of these impacts. We are concerned about the health of our family and the local ecosystem. It is important to us to know what these impacts will be. The very idea of spraying pesticides on an agricultural preserve seems contrary to the reasons for establishing it in the first place.

It is inexplicable why the County is rushing this ordinance without a proper environmental review. There are fewer eye gnats at the golf course this year than there were a couple years ago, so it seems that what Be Wise Ranch is doing is working. The County should wait to see the results of the natural measures that Be Wise is taking before enacting regulations that will hurt our local business and could potentially damage our environment.

Please consider the significant impacts on the environment and the health of our family that will be caused by your ordinance. Please do the right thing and work with Be Wise Ranch to find and enact a pesticide-free alternative to this ordinance.

Thank you,

Elizabeth Keenan

On behalf of our family

A.124

From: Sarah Anderson
To: LUEG, DEH-Eyegnat
Subject: Eye Gnat issues in San Diego
Date: Wednesday, June 20, 2012 10:48:52 AM

Dear Mr. Miller,

I have recently learned about the Eye Gnat issue here in San Diego and that organic farming may be impacted. As a resident here in San Diego, I am highly opposed to chemical spraying and pesticide use. I grew up in Northern CA in a highly agricultural area where spraying was prevalent. I have severe allergies due to this type of pesticide use. Therefore, it is extremely important to protect my children and providing them healthy organic foods is part of that. I ask that your department please look into alternative measures and research this issue further. Pesticide and chemical use is not healthy for the people of San Diego, our ecosystems, or waterways.

I appreciate your assistance in this matter,

Sincerely,

Sarah Anderson
Carlsbad Resident of San Diego County

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A.125

From: Anthea Beletsis
To: LUFG, DFH-Eyegnat
Subject: Eye gnat ordinance
Date: Wednesday, June 20, 2012 11:12:46 AM

Dear Mr. Miller,

I am writing to request that a full EIR be completed for the County's proposed Eye Gnat ordinance and Program. I am very concerned that the spraying of pesticides on organic crops, not to mention the surrounding community will be extremely harmful.

My family has been one of thousands that have benefited from the produce of Be Wise Ranch for many years. I am a member of the Be Wise CSA and also purchase Be Wise produce at my local grocery store. I choose to buy organic for my family's health and the health of the environment I share with other San Diegans.

Be Wise Ranch, with it's organic methods, has been an important asset to our community and to the San Pasqual Valley. Please do not eliminate their ability to be organic by unnecessarily forcing pesticides into the area.

Please take the time to do a full and proper environmental review before introducing pesticides and regulations that may be unnecessary.

Anthea Beletsis
1269 Blue Sky Drive
Cardiff, CA 92007
antheab@pacbell.net

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A.126

From: April Isbell
To: LUFG, DEH-Evegnat
Subject: Let us buy organic!
Date: Wednesday, June 20, 2012 11:53:56 AM

Please let us buy our food, pure and whole, like we are entitled to!

Graciously,
April Isbell

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A.127

From: eklahn@san.rr.com
To: [LUEG, DEH-Eyegnat](#)
Subject: Eyegnats
Date: Wednesday, June 20, 2012 12:36:53 PM

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

I urge you to consider the consequences of your vote to reclassify eye gnats as a vector problem and adopt a Negative Declaration that bypasses a full environmental impact study. I believe this provides almost no analysis of important environmental impacts that would be caused should this Eye Gnat Program and Ordinance be placed in effect. San Diego County houses a jewel of an organic local farm market that could be threatened if this action is taken.

As I am sure you are aware, local organic farming promotes health, ecology and small business. Citizens of San Diego are able to provide healthy meals of unique quality based on the quality of produce from these farms. Air quality is improved by local organic produce that doesn't have to be shipped long distances as well as chemicals that don't need to be used to preserve produce shipped long distances. These small organic farms create jobs in our community.

I choose to live on a canyon in San Diego County for the experiences of nature. As such, raccoons eat the fish in my little pond, bunnies eat all the flowers I plant and occasionally I have a rattlesnake visitor – sometimes even in my back door! Working in my yard sometimes disturbs the gnats that fly into my eyes and ears. I choose to live on this canyon and must deal with the consequences. As a child I spent summers on my aunt's small dairy farm in Pennsylvania. Blue bottle flies proliferated on the farm. My aunt's house was ringed with fly paper to control the nuisance. Living in the southeast, residents today use electronic gadgets to fry bugs that enter their territory. There are ways to combat nature at a more reasonable level than by chemicals distributed on open lands that severely inflict damage to homeowners, farmers and citizens.

I urge you to not vote for the chemical fix to alleviate the problem of eye gnats. There are other solutions that don't poison the environment and will allow our wonderful organic farms to thrive. A full environmental impact study should be initiated to truly evaluate the cost of chemicals on the community.

Thank you for your consideration.

Sincerely,

Ellen L. Klahn
5854 Pacific Haven Court
San Diego, CA 92121

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A.128

From: Carla Smith
To: LUEG, DEH-Eyegnat
Subject: "Eye Gnat Ordinance and Program"
Date: Wednesday, June 20, 2012 12:37:00 PM

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego CA 92123

Dear Mr. Miller,

I'm writing to request that a full Environmental Impact Report (EIR) be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed Eye Gnat Ordinance and Program seems to rely on subjective criteria, which can vary by person and by day, and are not verifiable. What objective criteria, such as counts, will be used to monitor the presence of eye gnats? How will the success/failure of mitigation measures be determined?

How will the County determine when to spray pesticides at Be Wise Ranch? What constitutes a "last resort?" How will the use of "last resort" measures be justified? How will the success/failure of pesticide use be determined?

The Negative Declaration does not adequately address impacts to endangered and threatened species. A full EIR is needed to evaluate these impacts.

The proposed ordinance appears to be hastily edited. It has sections that do not make sense. An example of this is found in Section 64.403.(g), which states, "Except as a last resort, the Director may not order a commercial organic grower to implement any eye gnat abatement measure that is not a validated, applicable and practicable eye gnat abatement measure for that farm." This means that the Director may, as a last resort, order an abatement measure that is not a validated, applicable and practicable. Is this what was intended?

The proposed ordinance adds eye gnats to San Diego County's definition of "vector," even though eye gnats have not been shown to transmit human disease in San Diego County. This violates the spirit and intent of California law. The California Legislature granted broad statutory authority to local agencies in order to control vectors of human disease pathogens, not arbitrary nuisances. How does the County justify this?

I look forward to a response to my questions and comments.

Sincerely,

Carla M. Smith
1536 Felton Street
San Diego, CA 92102

A.129

From: Lisa D'Addazio
To: LUFG, DEH-Eyegnat
Subject: Comments on eye gnat program from a concerned citizen
Date: Wednesday, June 20, 2012 12:46:36 PM

I am a resident on North San Diego County, and I regularly buy organic foods for my family. Requiring organic farms to spray for eye gnat is a direct infringement on San Diego county citizens' rights to purchase organic foods. The USDA, when it certifies an organic product, is promising Americans a truly organic, naturally safe product free from harmful pesticides and/or herbicides. Farms like Bee Wise Ranch, and others in the area, supply families like mine with wholesome, organic food, and it is not only ethically wrong, but also unconstitutional to demand that such organic food providers use chemicals to grow their food. Scientific studies have shown that ingredients in most pesticides can lead to various possibly fatal diseases, and I have the right under the U.S. Constitution to provide my family with clean, healthy foods devoid of such known hazardous substances. The passage on this bill is a most definite violation of Americans' right to Life, Liberty, and the Pursuit of Happiness. Requiring pesticide use puts our right to a healthy life in danger, infringes on organic farms' right to liberty and the freedom to choose how to grow their products, and causes our right to the pursuit of a happy, healthy life to dissolve. Forcing farms to use chemical pesticides is obviously not the best option. Farms should be able to choose for themselves what to use or not to use on the produce. Why not use natural methods of pest control such as the eye gnat traps proposed on the sdcounty.ca.gov website and leave our rights as American citizens intact?

Sincerely and in earnest,
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A.130

From: Adrian
To: LUEG, DEH-Evegnat
Subject: Eye Gnat Ordinance and Program
Date: Wednesday, June 20, 2012 12:47:13 PM

To Whom it May Concern,

The proposed Negative Declaration is the third instance of certain elected officials refusing to listen to their constituents that I am aware of. A proposed ordinance was already brought up twice for attempted vote before this, and both times there was a very strong response from the community that the proposal was not in the best interest of the citizens of San Diego County. Nothing has changed in the past month or so since the last time an ordinance like this was brought up, the reasons to reject it are still the same.

Referring back to the meeting I attended with fellow citizens of San Diego County, where the board of supervisors, several experts, and fellow citizens discussed the eye gnat problem, the most resounding resolution that was agreed upon by all sides was that we knew too little about the problem and the best way to combat it, to make a law governing any such attempt. A few months has certainly not changed that, and passing a law to put a "band-aid" on the problem is not going give the citizens of San Pasqual Valley what they deserve, a real solution.

The citizens of San Pasqual Valley and Escondido are very informed, and do not want a temporary fix, but a real long term, and lasting solution. The proposed Negative Declaration cannot even promise to provide temporary relief, as again, according to leading scientists and experts in the field, we DO NOT KNOW ENOUGH to provide a practical solution at this point.

My question to you as you consider this declaration is not whether it will provide a solution to the eye gnat problem, it has already been established that it will not. My question is why aren't the elected officials of San Diego County listening the the people of San Diego County? How many times do we have to say no before we are heard? I'll support a law that is founded on solid research and evidence that it will provide a solution. But this declaration is at best political postering, and at worst, a direct attack on local business. Our officials should be working for us, not against us.

Sincerely,

Adrian Nutter

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A.131

From: [Kevin Grangetto](#)
To: [LUEG, DEH-Eyegnat](#)
Cc: [Dominique Lehmer](#)
Subject: Comment on Eye Gnats
Date: Wednesday, June 20, 2012 12:59:36 PM

I believe that using IPM strategies for the control of nuisance insects is a better option than synthetic pesticides which can perpetuate in the soil profile, enter our groundwater environment and result in adverse affects on native soil and fauna. Please consider other sustainable options as they relate to controlling this pest otherwise organic growers like Be Wise Ranch and others will be forced to close their doors.

Thank you
Kevin

Kevin Grangetto

Owner

Grangetto's Farm & Garden Supply

PO Box 463905

Escondido, CA 92046-3095

(760) 745-4671 x201

kgrangetto@grangettos.com

www.grangettos.com

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A.132

From: Dominique Lehmer
To: LUEG, DEH-Evegnat
Subject: EYE GNATS
Date: Wednesday, June 20, 2012 3:06:26 PM

Hello,

I believe that there are better ways to control nuisance insects, (using more modern integrated pest management strategies) that employ modern methods, more suitable for the fragile environments that border southern Escondido.

It is well document that some synthetic chemistry can have negative long term impacts on humans, native plants and domestic animals .

Please consider more sustainable solutions to this problem before we lose the investment in the resource that agriculture provides to the community.

Regards,

Ed Grangetto
Escondido Growers for Agricultural Preservation
Cell: 760-801-8718
Fax: 760-745-4138
www.grangettos.com



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A133

From: sai108@aol.com
To: [LUEG, DEH-Evegnat](#)
Subject: Oppose the Negative Declaration and Request a full Environmental Impact Report for the San Diego proposed Eye Gnat Ordinance and Program!
Date: Wednesday, June 20, 2012 3:15:59 PM

Bambi Merryweather
6457
La Jolla,, CA 92037-5448

June 20, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

PLEASE, PLEASE, PLEASE. I CAN NOT BELIEVE THAT I EVEN HAVE TO WRITE THIS LETTER. HOW CAN ANY ONE THINK THAT THE SAN DIEGO EYE GNAT ORDINANCE, AS IT IS WRITTEN WOULD BE A GOOD THING. ORGANIC FOOD IS SO IMPORTANT FOR OUR HEALTH AND FOR FUTURE GENERATIONS. THE ORGANIC LANDS SHOULD NOT BE PUT AT RISK OF PESTICIDES. WOULD YOU CONSIDER AN ALTERNATIVE TO PESTICIDES, IF IT COULD BE PROVEN TO TAKE CARE OF THE GNAT PROBLEM? WOULD YOU GIVE ME A CHANCE TO SUPPLY AN ALTERNATIVE.? THIS JUST CAME ACROSS MY DESK TODAY...

BAMBI MERRYWEATHER
858-454-1487 THANK YOU!!

Sincerely,

Bambi Merryweather

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A134

From: [wendy hightman](#)
To: [LUEG, DEH-Eyegnat](#)
Cc: [Jane Smitham Bio 144 Lab](#)
Subject: RE: Eye Gnat Ordinance and Program – Negative Declaration
Date: Wednesday, June 20, 2012 3:23:22 PM

Via E-mail: eyegnat@sdcounty.ca.gov

Jack Miller

Department of Environmental Health

5570 Overland Avenue, Suite 102

San Diego, CA 92123

RE: Eye Gnat Ordinance and Program – Negative Declaration

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared for the proposal is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The current proposed ordinance will end Be Wise Ranch's organic status, an industry that provides my family, and my community with a safe food source. I am entirely uncomfortable with the idea that the County impose upon organic farming the spraying of unsafe pesticides on our food source. These pesticides include Acephate, Malathion, Diflubenzuron, Cyromazine, and Cyfluthrin, all of which are associated with both known and as yet unknown dangers to human health. Furthermore, they destroy the ecosystem of pesticide free farming. When pesticides destroy the ecosystem, this in turn creates much greater problems; including the introduction of pesticide resistant pests may take up residence in a crop where a natural ecosystem could have kept them in check. Organic farming is a niche industry with constantly increasing consumer demand. By insisting on the precipitous actions of pushing through this ordinance without first obtaining a full environmental impact report will result in the decreased value of life in San Diego and a decrease in the prosperity of a niche industry. Safe and cost-effective solutions to the Eye Gnat situation are available through a full Environmental Impact Report. Investment in a full Environmental Impact Report is a minor investment that frees the city of its citizen's criticism because it shows due diligence. Furthermore, the long term cost of this proposed ordinance program to the citizens of San Diego and to the County may be easily offset by investment in a full Environmental Impact Report. I urge you to put as a first priority the health of all San Diego's citizens and obtain a full Environmental Impact Report with a detailed analysis that will allow the city to select a safe alternative to spraying.

Thank you,

Wendy Dee Hightman, San Diego Citizen

wendyhightman@hotmail.com

(619) 977-3645

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A.135

From: [Lafreniere, Rebecca](#)
To: [LUEG, DFH-Eyegnat](#)
Subject: FW: Be Wise Ranch
Date: Wednesday, June 20, 2012 4:48:12 PM

Rebecca Lafreniere, Chief
County of San Diego
Department of Environmental Health
Community Health Division
5570 Overland Avenue, Suite 102
San Diego, CA 92123-1215
(858) 694-3595
fax (858) 571-4268

From: Owen Morrison [<mailto:omart@cox.net>]
Sent: Wednesday, June 20, 2012 4:08 PM
To: Miller, Jack
Subject: Be Wise Ranch

June 20, 2012

Jack Miller

Department of Environmental Health

5570 Overland Avenue, Suite 102

San Diego, CA 92123

jack,miller@sdcounty.ca.gov

RE: THE PROPOSED EYE GNAT ORDINANCE NEGATIVE DECLARATION'S UNFAIR BE WISE RANCH IMPACT

Dear Mr. Miller:

The Negative Declaration that was prepared for the County's proposed Eye Gnat Ordinance and Program, is inadequate and provides almost no analysis of the ordinance's actual environmental impact. Spraying Malathion, Cyromazine, Acephate, Diflubenzuron, and Cyfluthrin or similar pesticides on Be Wise Ranch's organic crops will unquestionably and unnecessarily **destroy** this beneficial company's business. These poisonous agricultural products pose serious water-borne public health risks and Be Wise Ranch President Bill Brammer informed me that he alerted the Department of Environmental Health that a recent five month measurement sponsored by your department demonstrated 98% eye gnat incidence reduction via safe, non-polluting methodology.

Whether by proper and fully justified supervisory action or in court, this unnecessarily harmful proposed ordinance will be defeated. Please thoroughly consider its impact now.

Thank you,

Robert Owen Morrison
3225 Mary Lane
Escondido, CA 92025
omart@cox.net

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Continu

A.136

From: Cori Butler
To: LUFG, DEH-Eyegnat
Subject: Be Wise Ranch
Date: Wednesday, June 20, 2012 4:53:31 PM

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important impacts that will be caused by the ordinance.

I am currently a member of the CSA provided by Be Wise Ranch. I am concerned that the spraying of pesticides will force Be Wise Ranch to lose their organic status. We support local farms that use sustainable practices. It seems that this would be in everyone in the community's interest as well.

Please consider the impact to the health of the community and my own family that will be created by your ordinance. Please do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you,

Corianne Drabinski

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A.137

From: Andrea
To: LUEG, DEH-Eyeonot
Subject: Save Organic Farms
Date: Wednesday, June 20, 2012 8:31:40 PM

Please don't destroy our counties Organic Farms. Pesticides harm all residents and damage the environment. I'm sorry a few people are bothered by gnats but that doesn't mean we should destroy organic farming--many many more people buy organic in the county than are bothered by gnats.

Andrea Plummer, Poway

Sent from my iPhone

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A.138

From: Ruth Landaal
To: LUFG, DEH-Eyegnat
Subject: Recommending Against Approval of Negative Declaration for the Be Wise Ranch Area of Escondido - Requesting Full EIR
Date: Wednesday, June 20, 2012 8:35:17 PM

June 20, 2012

Jack Miller
Department Of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Mr Miller

It has come to my attention public comments are being gathered through today on the proposal to declare a negative declaration for spraying the areas in Escondido around the Be Wise Ranch Organic Farm for an eye gnat infestation. As a member of the Be Wise Ranch CSA who receives bi weekly boxes at my neighborhood, I am in support of requiring a full environmental impact study. The Be Wise Ranch has let me know if the spraying for the eye gnats is allowed to proceed it will mean Be Wise will lose their organic designation which will be very damaging to this community business which would no longer be able to claim itself as being organic. Along with others in this community, I am buying produce from this farm because it is organic.

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I have not had a chance myself to study the alternatives for the eye gnat, but I understand that Be Wise Ranch has been trying to implement other means to reduce the population of this pest, and I support giving those methods a full try.

I recall a few years ago when the white fly infestation was so severe here in San Diego county, and now the past couple years it has not been so bad, and I wonder if there are cycles for the eye gnats, too. A full environmental impact study would help us to know all the impacts.

2

Please pass along my request that the negative declaration not be approved and that a full environmental impact report be obtained in this matter.

Ruth Landaal
1467 Vista Claridad
La Jolla CA 92037

A.139

From: ajcrane1@roadrunner.com
To: [LUEG, DEH-Eyegnat](#)
Subject: Oppose the Negative Declaration and Request a full Environmental Impact Report for the San Diego proposed Eye Gnat Ordinance and Program!
Date: Wednesday, June 20, 2012 8:50:56 PM

Andrew Crane
1834 Pleasantdale Drive
Encinitas, CA 92024-4249

June 20, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

Dear San Diego County Public Official,

The problem of eye gnats in San Diego County is undoubtedly a serious problem for many people but the proposed Ordinance and Program to remediate it is too much, too soon. I believe that more study must be done to come up with economically and environmentally less destructive measures. A full Environmental Impact Report should be undertaken to look at all aspects and potential consequences of the proposed actions and to find less severe alternatives.

We live in a time when the dangers of toxic materials in our food, air and water are well known; we must not endanger the very farms which are attempting to grow our food without poisons. Moreover, it is not acceptable to solve one problem by the use of poisons while creating a new one, namely the possible contamination of local waterways with pesticides.

Sincerely,

Andrew J. Crane
7605791862

A.140

From: Gary Spoto
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: Eye Gnat Ordinance and Program - Negative Declaration
Date: Wednesday, June 20, 2012 10:11:24 PM

Gary Spoto
14151 Palisades Drive
Poway, CA 92064
June 20, 2012

Jack Miler
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Mr. Miller:

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides (Acephate, Malathion, Diflubenzuron, Cyromazine and Cyfluthrin) on the organic crops grown at Be Wise Ranch. This will mean the end of Be Wise Ranch's organic status, and more importantly, an end to the healthy, fresh and local produce that the farm provides for me and my family, and a loss of productive organic farmland. I am a member of the Be Wise Ranch CSA (Community Supported Agriculture) which provides fresh vegetables to me at a pick-up site in my neighborhood in Poway.

I am also concerned that the spraying of pesticides will impact the plants and animals in the San Pasqual Valley. Your document looks focuses on County policies, but the impacts to Be Wise Ranch and the Valley are in the City of San Diego. The San Pasqual Valley is a City open space park and agricultural preserve; and it supports endangered and threatened species like the Arroyo Toad, the Least Bell's Vireo, and California Gnatcatcher. The Be Wise Ranch's organic farming methods are in harmony with the protection of these species since it uses natural techniques to grow crops and control pests. Spraying pesticides would change the nature of farming in this area and allow pesticides to enter the food chain of the animals in this area. Your environmental document gives no analysis to these impacts. I am concerned about the health of my family and the local ecosystem and want to know what these impacts will be.

It has been reported that the Eye Gnats at the golf course have diminished significantly compared to a couple of years ago indicating that the steps Be Wise Ranch has taken so far seem to be working. I encourage you to wait to see the results of what the Ranch has been doing before enacting more regulations that would hurt our local businesses.

Please consider the significant impacts to the environment and to the health of my family that

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will be created by your ordinance. I ask you to work with Be Wise Ranch on a pesticide-free alternative to this ordinance. Thank you.

Sincerely,

Gary Spoto

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Continue

A.141

From: [Birgit Neukirch](#)
To: [LUEG, DEH-Evegnat](#); [Cox, Greg](#); [Slater, Pam](#); [Ron-Roberts](#); [Jacob, Dianne](#); [Horn, Bill](#); [carldemaio@sandiego.gov](#); [Horn, Bill](#); [steve@steve.danon.com](#); [campaign@daverobertsforsupervisor.com](#)
Subject: Full Environmental Impact Report for Eye Gnat
Date: Wednesday, June 20, 2012 11:56:29 PM

Jack Miller
Department of Environmental Health
San Diego, CA

Dear Mr. Miller,

I am writing to request a full Environmental Impact Report for the Eye Gnat Ordinance and Program that was recently adopted by the San Diego County Department Of Environmental Health and The County Board of Supervisors. The proposed adoption of a Negative Declaration bypasses a full environmental impact study. I believe that the Negative Declaration is inadequate and provides almost no analysis of important environmental impacts that would be caused should this Eye Gnat Program and Ordinance be placed in effect.

The Ordinance would give the County the right to spray pesticides on organic crops grown by Be Wise Ranch.

I have been a buyer and consumer of Be Wise's organic produce for more than 10 years and consider their work essential to health conscious consumers and for an intact environment. There needs to be a place for a nature preserves and natural, intact agriculture in our San Diego county. We can consider ourselves lucky to still have some land that can be used for natural and healthy plant growing.

Please reconsider proposed ordinance and study the full environmental impacts of an ordinance that would allow to spray pesticides on crop that is certified organic, a certification that needs years of preparation to be obtained.

It is also important to recognized that Be Wise Ranch has already addressed the problem and is having some initial positive result with the Eye Gnat population. This could be the right step to address the problem in the future and keep the basis for organic food production .

Please work with Be Wise Ranch to find a pesticide free alternative.

Regards,
Birgit Neukirch
8150 Borzoi Way
San Diego, CA 92129

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A142

From: Nancy Madok
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Ron-Roberts; Jacob, Dianne; carldemario@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; Horn, Bill; Slater, Pam
Subject: Eye Gnat Ordinance and Program- Negative Declaration
Date: Thursday, June 21, 2012 11:22:56 AM

Good Morning,

I am writing to request that a full Environmental Impact Report be prepared for the County's proposed Eye Gnat Ordinance and Program. The Negative Declaration that was prepared is inadequate and provides almost no meaningful analysis of important environmental impacts that will be caused by the ordinance.

The proposed ordinance gives the County the authority to order the spraying of pesticides on the organic crops grown at Be Wise Ranch. This will mean the end to Be Wise Ranch's organic status, an end to the healthy, fresh produce the farm provides for me, my children and my cooking classes, and a loss of a productive organic farmland. I am currently a member of the Be Wise Ranch CSA, which provides fresh vegetables to me at a pick-up site in my neighborhood.

PLEASE consider the significant impacts to the environment, the loss of jobs and to the health of my family that will be created by your ordinance. PLEASE do the right thing and work with Be Wise Ranch on a pesticide-free alternative to this ordinance.

Thank you and To your health,
Nancy Madok

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A143

From: ROMANILLO, JESSICA D
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Date: Thursday, June 21, 2012 3:09:28 PM

Dear Mr. Miller,

I am requesting that a full Environmental Impact Report be conducted for the county's proposed Eye Gnat Ordinance Program. The proposed ordinance would allow the county to force the farm- Be Wise Ranch to spray harmful chemicals on the crops. This would mean no more local organic produce for myself or my family. The eye gnat traps are working and have reduced the eye gnats by 75-80%. Why would anyone want to spray chemicals on our food supply? My brother-in-law lives close to the ranch and has never had an eye gnat problem. What's the real motive here? Leave the organic farms alone. Why do I need to fight for my right to fresh, organic, local produce? I do not eat chemical laden processed foods and Be Wise Ranch is my main food source.

Thank you,

Jessica Romanillo

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A.144

From: Janet K. Shelton
To: DEH, Vector; Cox, Greg; Jacob, Dianne; Slater, Pam; Ron-Roberts; Horn, Bill
Subject: Fwd: Modify the Eye Gnat Ordinance
Date: Wednesday, June 20, 2012 6:01:36 PM

In February I wrote to recommend a more balanced and science-based approach to the eye gnat problem. Instead of being more balanced, the revised ordinance goes in the opposite direction, allowing the county to require Be Wise Ranch to apply pesticides that will destroy its business. The ordinance also does not give the farm adequate recourse or review, except through the courts.

There are many flaws to the ordinance. I live in the area affected by eye gnats, and I do understand how annoying they are. Yet, I expect the county to balance my needs against the rights of the farm. If this ordinance is passed, I think we are sending a very bad message about the county and its lack of support for organic agriculture.

The specific issues I see are:

The farm is in an agriculture preserve and its farming methods directly affect the residents and wildlife in the Lake Hodges watershed. A full environmental review should be required before pesticides can be applied there. If the farm is destroyed, the buffer is gone and more intensive building is likely to occur to the detriment of the watershed and the park.

The county seems to be swayed by a few activist homeowners and is not considering all viewpoints in the affected area. Activist homeowners have spread lies to the community repeatedly saying the farm was doing nothing when it had already put up hundreds of traps and a barrier. Their clear goal has been to get residents upset so they will lobby for the farm's destruction. They seem to think the correct number for eye gnats is zero, and this is not attainable.

The county seems willing to destroy a business that is a huge investment over many years, employs many people, and provides organic food to thousands of people all over the county. The rights of the farm, its employees and its customers are ignored. Nor are the needs of wildlife the park and the lake, the people who drink the water, etc. adequately considered.

The county has left the farm to figure out what will work and they have voluntarily done their best to do all they can to reduce eye gnats. This program is ongoing, and the results are certainly not in. The county does not have adequate information to proceed with this ordinance. All the burden and expense has been put on the farm, but at the same time, the county seems unwilling to do anything about all the irrigated areas that are part of the eye gnat's life cycle. I have reviewed every document I can find and I think eye gnats are inadequately studied.

I believe this ordinance's excessive reach and the idea that a full environmental review is not required are wrong and that this will just mire the county in legal action that the farm will be forced to take in order to try to survive.

Janet K. Shelton
1276 Via Sendero

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Escondido, CA 92029
760 747 5761

From: Victoria Cabot [victoria_cabot@yahoo.com]
Sent: Friday, June 22, 2012 12:35 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Ron-Roberts; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; steve@stevedanon.com; campaign@daverobertsforsupervisor.com; Victoria
Subject: Eye Gnat Ordinance and Program - about the Negative declaration

To: Jack Miller
Dept. of Environmental Health

Dear Mr. Miller,

I am writing about my concerns regarding the spraying of pesticides in the San Pasqual Valley, and specifically the measures that will affect the organic farm, Be Wise Ranch.

Two words: PLEASE DON'T!

I urge you to please execute a FULL Environmental Impact report of the County's proposed Eye Gnat Ordinance and Program. The negative declaration that was prepared is inadequate.

A full analysis is required prior to taking actions that will forever taint the soil, and greatly threaten the livelihood of a family business that employs many people and provide access to nutritious and organic foods for hundreds of others. I am one of them. I so greatly appreciate having access to this farm. These people work very hard to make a living and I am unclear why there is so much energy around this issue at the county level.

Bugs are part of the environment; they are not present simply because of this farm or the agricultural activities in this valley.

I am an active citizen in San Diego County, and I do watch these issues very carefully. And I vote.

I appreciate your consideration of my point of view.

Sincerely,

Victoria Cabot
858.472.9102

From: Lynne Anne Baker [baker@sdrvc.org]
Sent: Friday, June 22, 2012 1:50 PM
To: LUEG, DEH-Eyegnat
Subject: Notice & Comment

Gentlemen,

All information related to public comment should properly be noticed to the
San Dieguito River Valley Conservancy
3030 Bunker Hill Drive
San Diego, CA 92109.

Our Conservancy has worked for 26 years to protect water quality, conserve and restore the river valley. We own property in this vicinity, but have not received notice regarding this matter. We have conducted river restoration work in concert with the County of San Diego in this vicinity for many years, but are particularly minimalist regarding the use of any chemicals in proximity to Lake Hodges drinking water supply.

Please add us to the list of interested parties at your earliest convenience.

Lynne Anne
Lynne Anne Baker
Executive Director
San Dieguito River Valley Conservancy

858-755-6956 tel
858-356-4222 fax
P.O. Box 89, Del Mar, CA 92014

Securing our Natural Legacy . . .

A.147

From: Skelly, Leslie [Leslie_Skelly@intuit.com]
Sent: Friday, June 22, 2012 2:50 PM
To: LUEG, DEH-Eyegnat
Subject: Please don't pass the eye gnat ordinance

Please forward my email to Jack Miller – thank you!

Mr. Miller,

I respectfully request that you do not pass the ordinance that would enable the County to order the spraying of chemicals on organic farm land in San Diego County. I have been a Be Wise Ranch co-op participant for 6 years now, ever since I had the first of my children, and having organic produce locally grown is extremely important to me and many others that I know who also belong to the co-op.

Here's my story:

I was raised in a small farming town in Central Illinois. I saw so many of those living on or near farm and drinking water drained by farm land suffer from cancer and other less common ailments (Chrohn's disease, tumors in my 5 year old nephew, on and on). I can't help but believe that the chemicals we put on our ground to keep away pests and increase yields are in some part to blame, and as a mother of 6 and 4 year old girls, I do everything in my power to give them chemical-free, pesticide-free food. Please don't take away the ability of Be Wise, my main source of affordable organic produce, to remain certified organic (it would be such a blow to their business, I'm not sure they' recover if they lost the ability to market themselves as organic).

It appears Mr. Brammer has been brash in his approach, I hope it does not harm our chances of keeping Be Wise organic!

Respectfully
Leslie Skelly
(858)354-1395

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A.148

From: eileenhenot@sbcglobal.net
Sent: Monday, June 25, 2012 9:08 AM
To: LUEG, DEH-Eyegnat
Subject: Oppose the Negative Declaration and Request a full Environmental Impact Report for the San Diego proposed Eye Gnat Ordinance and Program!

Eileen Henot
1018 Florida Street
Imperial Beach, CA 91932-2926

June 25, 2012

Jack Miller
Department of Environmental Health
5570 Overland Avenue, Suite 102
San Diego, CA 92123

Dear Jack Miller:

I am writing to request that a full Environmental Impact Report be prepared for San Diego County's proposed Eye Gnat Ordinance and Program.

This issue is of special significance to me since my mother died of Parkinson's disease, a disease that has repeatedly been linked to pesticide exposure.

Sincerely,

Eileen Henot

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A.149

Malowney, Dorothy

From: Jones, Bobbie on behalf of DEH, Vector
Sent: Wednesday, July 18, 2012 11:28 AM
To: Malowney, Dorothy
Subject: FW: Reject the Eye Gnat Ordinance!

From: Doreen Borseth [<mailto:dborseth@gmail.com>]
Sent: Wednesday, July 18, 2012 10:11 AM
To: DEH, Vector
Cc: Cox, Greg; Jacob, Dianne; Slater, Pam; Ron-Roberts; Horn, Bill
Subject: Reject the Eye Gnat Ordinance!

Dear Chairman Roberts and Honorable Supervisors:

I am writing to express my serious concerns about new restrictions on organic farms in San Diego. The 'eye gnat' ordinance you are considering could force organic farmers to spray chemical pesticides, reduce their farmable acreage and shut down for weeks at a time during the productive summer months. Complying with these requirements would cause organic farms to lose their certification and create a negative financial impact that could potentially put them out of business.

Organic farms provide significant benefits to the San Diego region, promoting a healthy lifestyle for residents and contributing to the local economy. I urge you to protect the future of this important industry and reject the proposed eye gnat program and ordinance in its current form.

Please give organic farmers a chance to implement safer, more proven methods to control the eye gnat issue, which has existed for decades in San Diego. The County should reject this ordinance and explore alternatives that would not negatively affect organic farmers by looking at the successful eye gnat control programs in the Coachella Valley and Yuma, Arizona.

Thank you for your consideration.

Sincerely,

Dr. Doreen Borseth

A.150

From: Jeanne Cate [jcate@nethere.com]
Sent: Sunday, July 22, 2012 2:43 PM
To: LUEG, DEH-Eyegnat
Cc: Cox, Greg; Slater, Pam; Roberts, Ron; Jacob, Dianne; Horn, Bill; carldemaio@sandiego.gov; Steve@stevedanon.com; campaign@daverobertsforsupervisor.com
Subject: pesticide spraying/eyenat spraying

Stop the spraying.

You can't control where the pesticides end up. And I don't want them in me from the food, nor the water, nor the air.

Sure, eyenats are not pleasant, but as far as I can tell they haven't killed anyone in San Diego? yet?

So find another solution.

Give homeowners and others eyenat traps, invent one if there isn't one already on the market.

Get ridd of the breeding grounds in environmental friendly way. Let the home owners know how to do that, too, like is done with mosquitos.

Pesticide spraying should be a *last* resort, only when needed to save human LIVES, not in the name of convenience and comfort, and just because we have the "knowledge and luxury" of being able to do it..

Jeanne

56 years San Diego resident

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Taiga Takahashi
Direct Dial: 619.238.2890
taiga.takahashi@lw.com

A1.151

600 West Broadway, Suite 1800
San Diego, California 92101-3375
Tel: +1.619.236.1234 Fax: +1.619.696.7419
www.lw.com

LATHAM & WATKINS LLP

July 30, 2012

VIA E-MAIL & FEDEX

Department of Environmental Health
ATTN: Eye Gnat Ordinance and Program
5570 Overland Avenue, Suite 102
San Diego, California 92123

FIRM / AFFILIATE OFFICES

Abu Dhabi	Moscow
Barcelona	Munich
Beijing	New Jersey
Boston	New York
Brussels	Orange County
Chicago	Paris
Doha	Riyadh
Dubai	Rome
Frankfurt	San Diego
Hamburg	San Francisco
Hong Kong	Shanghai
Houston	Silicon Valley
London	Singapore
Los Angeles	Tokyo
Madrid	Washington, D.C.
Milan	

File No. 051247-0000

Re: Krout & Associates Report on Proposed Eye Gnat Ordinance Effect on Greenhouse Gas Emissions

Please find enclosed a report by Krout & Associates regarding the proposed Eye Gnat Ordinance and Program's potentially significant impacts on greenhouse gas emissions. This report provides further support for our previous comments on the proposed ordinance—a full environmental impact report must be prepared in order to comply with the California Environmental Quality Act.

We request that the County include this report as part of the administrative record and as part of your deliberations on the proposed ordinance. Be Wise Ranch has been voluntarily implementing a successful control plan for eye gnats, and it would like to continue to devote its resources to continuing to fight and control eye gnats rather than to defending against unnecessary regulation. We recognize that the official public comment period has closed but note that for the purposes of exhausting administrative remedies, comments may be submitted at any time prior to certification of environmental review. (See Pub. Res. Code, section 21177; *Galante Vineyards v. Monterey Peninsula Water Mgmt. Dist.* (1997) 60 Cal.App.4th 1109, 1117–1121.)

Best regards,



Taiga Takahashi
of LATHAM & WATKINS LLP

Enclosures

cc: **VIA E-MAIL & FEDEX**

Rodney Lorang
Claudia Anzures

LATHAM & WATKINS LLP

Jack Miller
Rebecca Lafreniere
Linda Hollingsworth
Lisa Leondis
Greg Cox
Dianne Jacob
Pam Slater-Price
Ron Roberts
Bill Horn
Steve Danon
Dave Roberts
Carl DeMaio, c/o John Ly
David Martens
Chris Garrett
Bill Brammer

July 27, 2012

William Brammer
Be Wise Ranch
20505 San Pasqual Road
Escondido CA 92025

Subject: Qualitative Justification Letter that the Proposed County of San Diego Vector Control Ordinance Amendment Negative Declaration is Insufficient

Dear Mr. Brammer,

This letter is in response to the County of San Diego's proposal to adopt an ordinance to amend Title 6 of the San Diego County Code relating to vector control to establish a County-wide (incorporated cities and unincorporated area) Eye Gnat Program (the "Project"). The proposed ordinance would add eye gnats to the definition of a "vector" in Chapter 2 of Division 4 of Title 6 of the San Diego County Code thereby allowing abatement actions to be taken when it is determined that eye gnats are causing a nuisance to the public. The County of San Diego's Initial Study (IS) ER#12-00-001 states, *"Substantial numbers of complaints implicating organic farms as causing an eye gnat nuisance have been received for only two farms, the Bornt farm in Jacumba, and the Be Wise Ranch farm."* As a result, the County of San Diego proposes an Eye Gnat Program and Ordinance that would implement a progressive strategy for intervention when commercial organic farms cause an eye gnat nuisance.

1. Introduction

The Project strategy includes implementation of four measures. Initial measures involve agency coordination and cooperation with the offending farms, whereas the latter measure would force farms to apply measures detrimental to their "Certified Organic" certification. The final proposed measure (fourth of four) to be employed would:

- Authorize the Director of DEH (San Diego Department of Environmental Health) to require the use of conventional pesticides on organic crops or fields, or to restrict the crops that could be grown organically on a farm, as a last resort when eye gnats cannot be controlled by any other method.

While the language of the IS focuses on two specific farms: Bornt and Be Wise Ranch, the word "substantial" suggests that other "organic farms" also have complaints of "causing an eye gnat nuisance." **Therefore, all organic farms in San Diego County are implicated and affected by the proposed Project.**

Application of the listed pesticides identified in the IS would strip the organic farms of their "Certified Organic" labeling. Restricted from growing "Certified Organic" crops, organic growers in San Diego County would cease to operate under current conditions. From an economic and financial perspective,

the proposed Project and corresponding measures would be devastating, forcing the closure of organic growing operations in San Diego County.

From a California Environmental Quality Act (CEQA) perspective, implementation of the Project would have a Potentially Significant Impact on the environment. Implementation of the Project and the proposed measures would indirectly lead to the intensification of GHG emissions. **Therefore, the determination of “Less than Significant Impact” under, section VII. GREENHOUSE GAS EMISSIONS, and the resulting determination to prepare a Negative Declaration are insufficient.**

2. Background

Since the late 1990s, U.S. organic production has more than doubled, but the consumer market has grown even faster. Organic food sales have more than quintupled, increasing from \$3.6 billion in 1997 to \$18.9 billion in 2007. More than two-thirds of U.S. consumers buy organic products at least occasionally, and 28 percent buy organic products weekly. This fast-paced growth has led to input and product shortages in organic supply chains (USDA 2009).

In 2010, San Diego County had over 302,000 acres of farmland. Approximately 42,500 acres, or fourteen percent, of all farming land was used for fruit or vegetable crops with a total value of over \$420 million (County of San Diego 2010). In 2011, the County had 347 registered organic growers producing over 150 different crops on approximately 6,700 acres (County of San Diego 2012). The organic growers produce predominately fruits and vegetables. While organic farms comprise approximately two percent of total farmland in the County, they account for sixteen percent of fruit and vegetable crop farmland.

3. Local and Regional Planning Regulations

3.1 County of San Diego General Plan

“Sustainability is a key theme of this [San Diego County] General Plan and is inextricably related to a number of General Plan elements, as well as land use topics” (County of San Diego 2011). Within the Land Use and Conservation Elements, the emphasis on the preservation and the conservation of agricultural land, and notably, the direct support for organic farming, illustrates the importance of agriculture to the region’s sustainability. The goals and policies illustrated below are in direct conflict with the proposed Project:

GOAL LU-5 Climate Change and Land Use

A land use plan and associated development techniques and patterns that reduce emissions of local greenhouse gases in accordance with state initiatives, while promoting public health.

Policy LU-5.3 Rural Land Preservation

Ensure the preservation of existing open space and rural areas (e.g., forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas) when permitting development under the Rural and Semi Rural Land Use Designations.

Specific Conservation Goals and Policies in the County of San Diego's General Plan promote development and conservation of a sustainable agricultural industry in San Diego County. The General Plan finds organic farming desirable for its "economic diversity" and increased "competitiveness" for agriculture.

Goal COS-6 Sustainable Agricultural Industry

A viable and long-term agricultural industry and sustainable agricultural land uses in the County of San Diego that serve as a beneficial resource and contributor to the County's rural character and open space network.

Policy COS-6.1 Economic Diversity

Support the economic competitiveness of agriculture and encourage the diversification of potential sources of farm income, including value added products, agricultural tourism, roadside stands, organic farming, and farmers markets.

Policy COS-6.2 Protection of Agricultural Operations

Protect existing agricultural operations from encroachment of incompatible land uses by doing the following:

- Limiting the ability of new development to take actions to limit existing agricultural uses by informing and educating new projects as to the potential impacts from agricultural operations.
- Requiring development to minimize potential conflicts with adjacent agricultural operations through the incorporation of adequate buffers, setbacks, and project design measures to protect surrounding agriculture.

3.2 City of San Diego

The City of San Diego is also proponent of organic agriculture. The Mitigation, Monitoring, and Reporting Program for the San Pasqual Valley Plan (SPVP 2006) consists of goals, policies, and specific proposals that would contribute to avoiding, mitigating, or lessening the impacts that have been identified in the corresponding Environmental Impact Report. The SPVP Appendix recommends the additional measure for avoidance of agricultural impacts on water quality that includes "encouragement of organic farming."

Implementation of the Proposed project is in direct conflict with the goals and policies of the County of San Diego and the City of San Diego. Specifically, organic farming is encouraged to reduce impacts on the environment and support the economic viability of agriculture in the region. The County is actively pursuing measures to reduce VMT in the region and conserve valuable agricultural land as a long-term goal. Therefore, the proposed Project is inconsistent with the goals of the region.

4. Increase in Vehicle Miles Traveled = Increase in Greenhouse Gas Emissions

Implementation of the proposed Project and corresponding measure to apply pesticides has the potential to eliminate all organic farming in San Diego County. While the supply of organic crops would

be diminished, the demand in San Diego County for “Certified Organic” products would not decrease. Both new suppliers of organic products and specific consumers of the organic products will need to travel farther, increasing the amount of Vehicle Miles Traveled (VMT). Longer distance food distribution networks are not sustainable from a climate mitigation perspective.

4.1 New Out-of-Region Suppliers

A study from the Leopold Center for Sustainable Agriculture at Iowa State University found that in local and regional food systems, farmers and processors that sell and distribute their food to consumers within a given area may use less fossil fuel for transportation because the distance from farm to consumer is shorter (Pirog 2001). A similar study from the London-based Transport 2000 concluded, “that there appears to be some relationship between shorter supply chains and lower transport-related CO₂ emissions” (Garnett 2003).

New “Certified Organic” crop producers from outside of the County, not affected by the proposed Project’s constraints, would effectively increase the supply of “Certified Organic” products to replace the void left by closure of San Diego County’s currently existing organic growers. New organic produce could come from both U.S.-based and international organic growers. For example, organic strawberries may come from Oxnard or Watsonville, California. Organic tomatoes may come from Baja California in Mexico. As the point of departures (POD) would be outside of San Diego County, a calculation of VMT would include the POD distance to San Diego County *in addition* to the distribution routes for current San Diego County organic growers. The increased amount of fossil fuel used to transport food long distances will lead to the increase in greenhouse gas emissions resulting from the burning of these fuels.

4.2 CSA Members

Community Supported Agriculture (CSA) is sometimes referred to as “Subscription Farms” because the consumer buys a subscription from a farmer for a set price to receive fresh produce on a weekly or bi-weekly basis usually delivered to a pick-up location (San Diego County Farm Bureau 2012). Implementation of the proposed Project would lead to the demise of “Certified Organic” grower farm’s CSAs in San Diego County. As a consequence, current members (consumers) of CSAs, assuming constant demand, would purchase their “Certified Organic” products from stores in the region.

A survey by The Center for Agroecology & Sustainable Food Systems at the University of California, Santa Cruz found that close to half (45%) of central coast CSA members live less than 3 miles from their pick-up site (Perez 2003). Applying the same assumption to Be Wise Ranch farm’s 2,500 CSA members, there is a large probability the amount of fossil fuel necessary to obtain equivalent and comparable amounts of organic produce would increase. This increase in the use of fossil fuels would result in greater emissions of GHGs.

5. The CAPCOA Significance Threshold and Related Cumulative Impacts Under CEQA

A 900 metric ton of carbon dioxide equivalents (CO₂e) threshold was selected by the County to identify those projects that would be required to calculate emissions and implement mitigation measures to reduce a potentially significant impact. The 900 metric ton screening threshold is based on a CAPCOA

threshold that covers methods for addressing greenhouse gas emissions under CEQA. This threshold requires a substantial portion of future development to minimize GHG emissions to ensure implementation of AB 32 targets is not impeded.

The origin of new out-of-region organic growers that would replace current organic growers is unknown. However, out-of-region grower's GHG emissions can be calculated based on an estimation of current GHG emissions for organic growers within the County. Be Wise Ranch farm, one of the largest in San Diego County, estimates that 60-75 percent of their organic crop is sold locally: with local stores receiving 35-50 percent and Community Supported Agriculture receiving 25 percent (Brammer 2012). Be Wise Ranch farms estimates they use 18,000 gallons of fuel (gasoline or diesel) for on-farm operations of 162 acres. This equates to approximately 111 gallons of fuel used per year for on-farm operations. The assumption is made that all other competing organic growers (similar crop mix), in or out of the region, use approximately the same amount of fuel per acre for on-farm operations. Therefore, the GHG emissions associated with current or future organic growers is equal and are not considered towards the 900 metric ton GHG threshold. **The increase in GHG emissions from implementation of the proposed Project occurs from increased VMT from off-farm operations.**

Be Wise Ranch estimates they use 5,000 gallons of fuel (gasoline or diesel) per year for delivery of 162 acres of farmland products (Brammer, 2012). This results in approximately 31 gallons of fuel per acre per year for off-farm operations (distribution). Be Wise Ranch is one of the largest organic growers in San Diego County and it can be assumed they have an economy of scale for lower fuel consumption per acre than organic growers with fewer acres. As a conservative measure, this calculation assumes Be Wise Ranch fuel consumption is an *average* for the off-farm operations of all organic growers in the County.

A simple calculation of GHG emissions based upon fuel consumption is illustrated below:

1. Assume 31 gallons of fuel per acre per year is the average required for organic growers.
2. Multiply the 31 gallons per acre minimum to San Diego County's 6,700 acres of organic farms results in approximately 207,700 gallons of fuel used per year in aggregate by all organic growers in the County.
3. This fuel usage equals the emission 1,846 metric tons of CO₂e (EPA 2012).

The origin of new out-of-region organic growers that would replace current organic growers is unknown. However, based on the calculation and assumptions described previously, distributors of organic produce in San Diego County *cumulatively* emit over 1,800 metric tons of CO₂e through the burning of fossil fuels. To meet demand for the current mix of organic products within the County, new organic growers would most likely deliver produce from the Central Coast (Ventura County), the Central Valley, or Mexico. The out-of-region organic growers travelling into the region would at a minimum, emit volumes of CO₂e *equal or greater* to the current emissions. An increase of fifty-percent or more in travel distance and the corresponding increase in GHG emissions are easily possible. Just a fifty percent increase in GHG emissions by out-of-region organic growers (as a result of increased VMT) would meet the 900 metric ton threshold selected by the County of San Diego. Implementation of the proposed

Project would then be “required to calculate emissions and implement mitigation measures to reduce a potentially significant impact”. **Therefore, making the determination of “Less than Significant Impact” under, section VII. Greenhouse Gas Emissions is considered to be insufficient.**

This analysis recognizes that measuring the environmental impacts of bringing food to market is complex. To use the distance travelled or “food miles” assumes the fuel efficiency, and hence GHG emissions, for a vehicle is dependent on factors such as the type of vehicle, its age, the type of fuel used, maintenance and driver behavior (Smith, et al. 2006). However, short of actual GHG quantification, the future emissions as a result of implementation of the Project are unknown.

6. Conclusion

There is a strong possibility that implementation of the Eye Gnat Program and Ordinance will lead to closure of San Diego County organic farms. Negative environmental impacts would ensue as out-of-region organic growers and former San Diego County CSA members drive longer distances to deliver or purchase organic produce, consume more fossil fuels, and, as a result, emit greater amounts of GHG emissions. The County’s individual Project’s GHG emissions (from pesticide application) may not result in direct impacts under CEQA, as the climate change issue is global in nature. However, the individual project could be found to contribute to a potentially significant cumulative impact from indirect increases in VMT. The corresponding increase in GHG emissions would exceed the 900 metric ton threshold set by the County and require the calculation of emissions and implement mitigation measures to reduce a potentially significant impact. In addition, the Project is inconsistent with the County of San Diego and City of San Diego’s Conservation and Land Use goals and policies to encourage organic farming and reduce GHG emissions. **As a result, the determination of “Less than Significant Impact” under section VII. Greenhouse Gas Emissions and the final determination to prepare a ND are considered to be insufficient. Following CEQA Guidelines Section 15130(f), the County should be required to prepare an Environmental Impact Report (EIR) analyzing greenhouse gas emissions resulting from indirect impacts of the proposed Project, as the incremental contribution of the emissions may be cumulatively considerable.**

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Krout & Associates is a woman-owned, California based strategic consulting firm, whose mission is the development of customized solutions for our clients in the context of environmental, social and economic sustainability. Our environmental sustainability services range from climate adaptation vulnerability analysis/strategy selection; regulatory climate action plans; third-party certification and carbon foot printing of sustainable viticulture operations. Our economic and social sustainability services include socioeconomic and community impact analyses, public health assessments, and economic and fiscal impact analyses.

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Dr. John R. Weeks, Dennis Larson, Dr. Douglas A. Stow and Dr. Tarek Rashed. *"Contrast or Continuum: The Creation and Application of an Urban Gradient Index Using Remotely Sensed Imagery and GIS."* Prepared for the Annual Meeting of the Population Association of America, Minneapolis May 2003.

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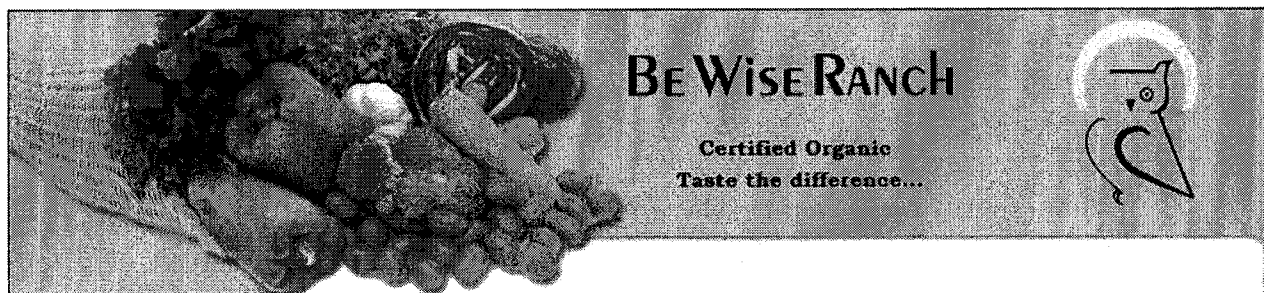
"Climate Adaptation and Food Security, Sowing Our Oats Now," The Environmentor- Association of Environmental Professionals. Chandra Krout, Dennis Larson, and Ellen Fehr. November 2011.

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Current responsibilities include development of the adaptation measures and corresponding strategies for the San Luis Obispo County Regional Greenhouse Gas Reduction Plan and the City of San Diego's Climate Mitigation and Action Plan. Previously, Ms. Fehr provided technical and analytical support for the City of San Clemente's Climate Action Plan and the City of Aliso Viejo's Green City Initiative Plan.

Ms. Fehr brings a wide range of abilities to projects including strong analytical, written, and verbal skills. Her project management skills ensure that Krout & Associates projects are on schedule, within budget, and exceed the client's expectations.



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Voluntary Eye Gnat Implementation Plan

What is Community Supported Agriculture (CSA)

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Share in the harvest.

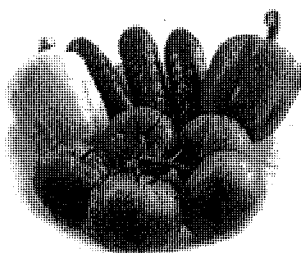
In a CSA, a community is created between a local farmer and consumers. The consumers purchase a "share" of the upcoming harvest produced on the farm. The cost of a share is based on the true costs of production. By purchasing a share, the consumers obtain farm-fresh, organic produce on a weekly basis while helping to keep a local family farm economically and environmentally viable.

Community Supported Agriculture (CSA) began in this country in 1985 in New England as a way of supporting social and ecological responsibility in the local community. Of the more than four hundred CSA's in the United States, a majority adhere to the principles of sustainable agriculture by using organic farming methods.



Shareholders of the Be Wise Ranch CSA, for example, not only enjoy farm-fresh certified organic produce, they also support the use of ecologically-responsible farming methods which improve the mineral and nutrient content of the soil, and recycle local green waste into compost. Organic farming helps preserve the water and air quality of their community by not using or encouraging the manufacture and use of chemical fertilizers, or dangerous chemical pesticides and herbicides.

A CSA brings the consumer and the farmer together - enhancing ecological diversity, facilitating the recycling of important nutrients and waste products, and maximizing the self-sufficiency of family farms.



What about you?

Would you like weekly deliveries of vine-ripened tomatoes and vegetables, and sweet juicy oranges at a reasonable cost?

Would you like to eat vitamin- and nutrient-rich produce grown organically, without the use of synthetic fertilizers and pesticides?

Would you like to encourage responsible, sustainable stewardship of a local, organic family farm right here in San Diego?

"Be wise" and join 2500 other families in San Diego who are members of the Be Wise Ranch Community Supported Agriculture (CSA) project, started in 1993.

Five reasons for joining Be Wise Ranch CSA:

You and your family will be able to eat tasty and nutritious farm-fresh produce year-round, delivered weekly (or every other week) to a location convenient to your home.

You will enjoy a wide variety of fruits and vegetables grown organically, without the use of synthetic fertilizers or pesticides.

You will encourage sustainable stewardship of a local family farm right here in San Diego.

You will join a community of over 2500 families in San Diego who are committed to social and ecological responsibility in the local community.

And you can do all this at a lower cost than buying the same produce at a supermarket!

Enjoy fresh produce year round at a reasonable cost.

Be Wise Ranch grows a wide variety of organic fruits and vegetables. Here in San Diego, we are blessed with a long growing season and we are usually able to supply you with farm-fresh produce year round. We specialize in growing organic fruits and vegetables whose farm-fresh flavor cannot be bought in a supermarket, such as fresh sweet corn and vine-ripened tomatoes. And, as a member of our CSA, you receive all of this fresh, nutritious, organically grown produce, grown locally on a family farm, delivered weekly to a convenient location to you - for less than what you'd pay in a supermarket.

You can select a share size (large or small) and a delivery schedule (weekly or every other week) appropriate to your needs. Use the links below to learn more about the Be Wise Ranch CSA project. We deliver boxes of produce to our members on a weekly or every-other-week basis to many [pick-up locations](#) in San Diego.

[For more information, see our CSA FAQ's](#)

[Join Our CSA](#)



SAN PASQUAL VALLEY PLAN



SAN PASQUAL VALLEY PLAN

City of San Diego Planning Department

202 C Street, MS 4A
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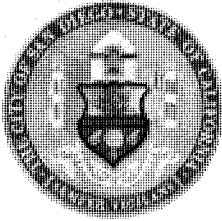
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SAN PASQUAL COMMUNITY PLAN

The following amendments have been incorporated into this February 2006 posting of this Plan:

Amendment	Date Approved by Planning Commission	Resolution Number	Date Adopted by City Council	Resolution Number
San Pasqual Community Plan adopted.	April 13, 1995	R-2180-PC	June 27, 1995	R-286043
			March 1996	R-300686
			July 19, 2005	R-300686



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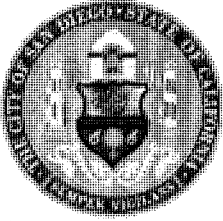
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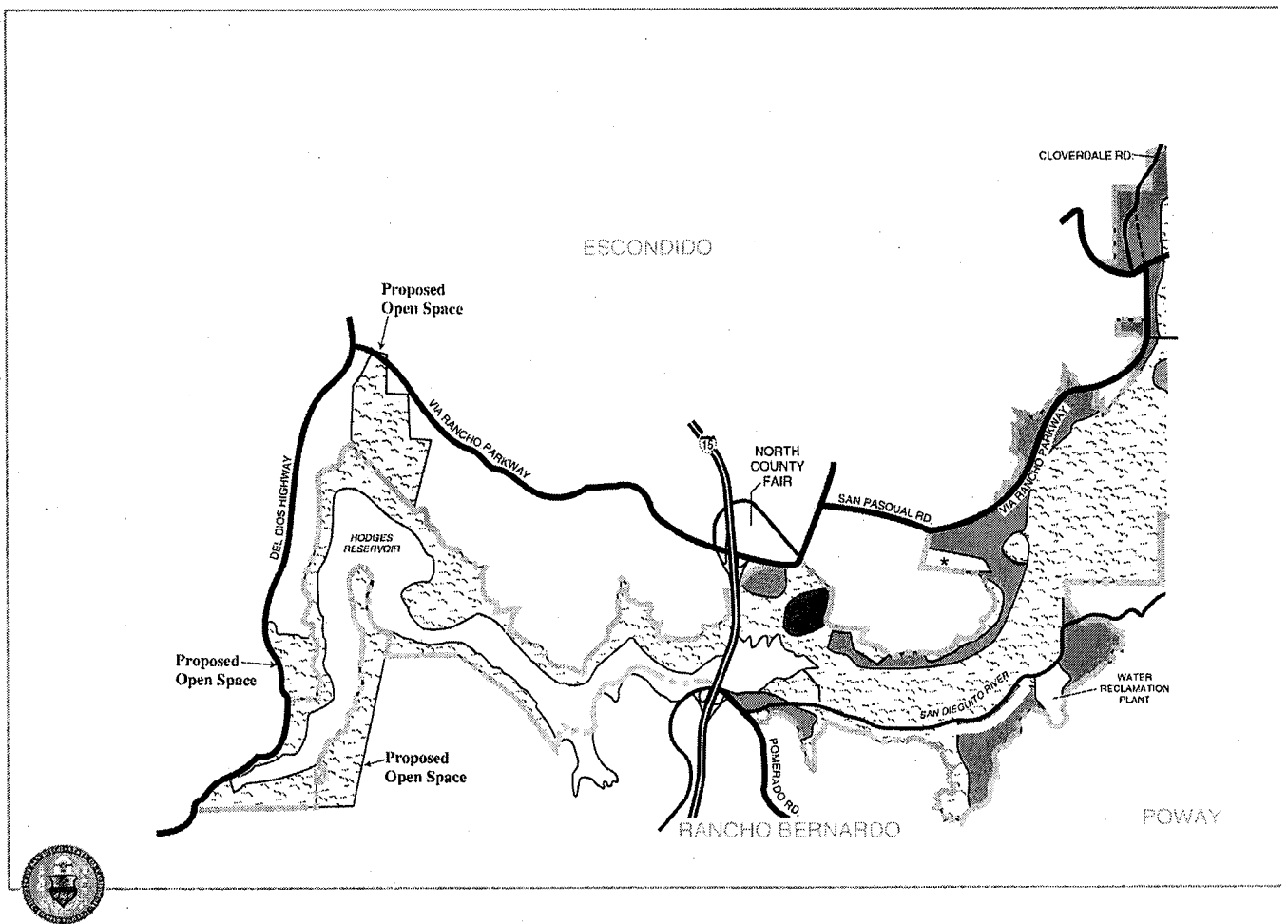
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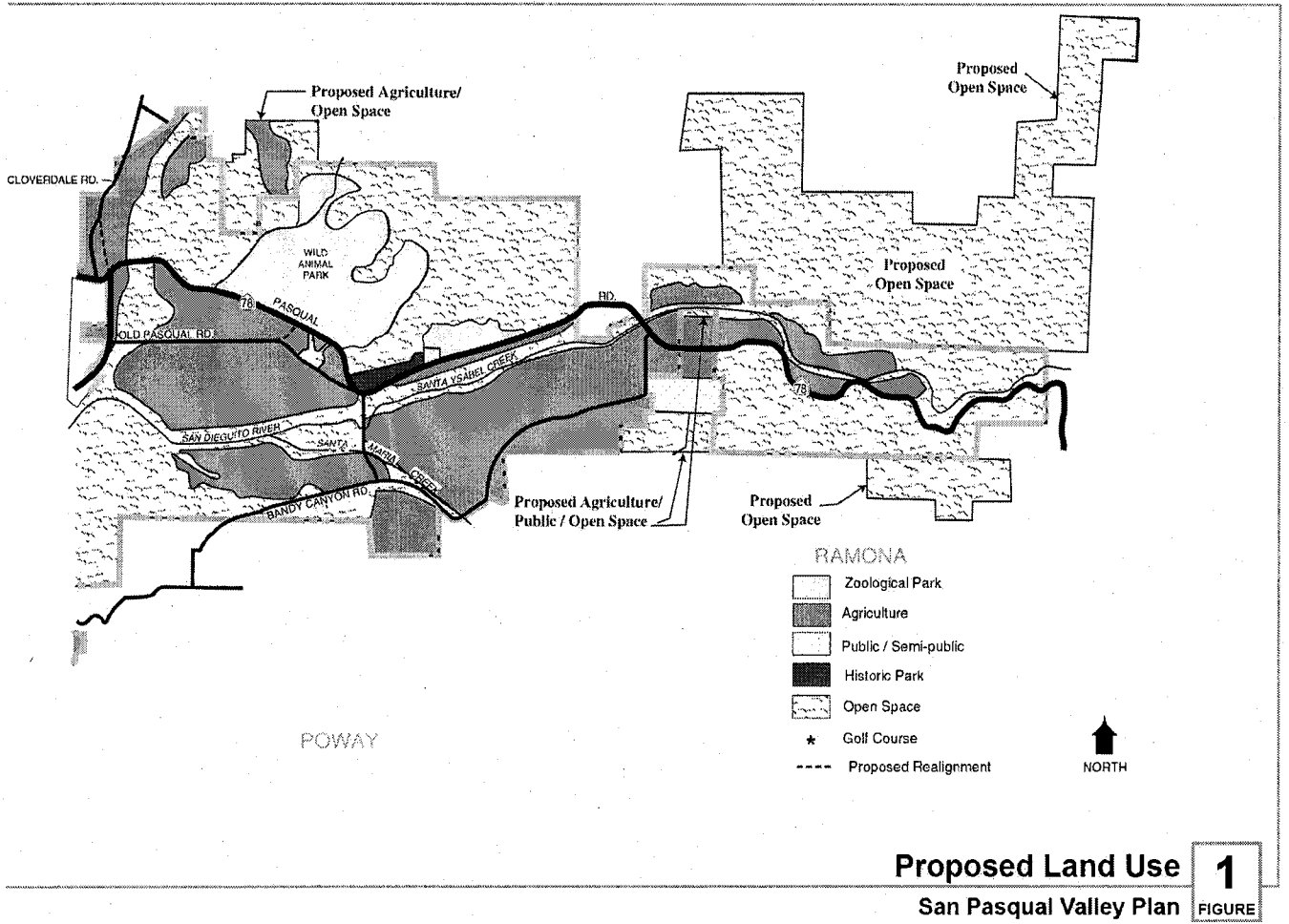
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Executive Summary



- Plan Vision
- Key Community Issues
- Overall Goals
- Proposed Land Use Map





EXECUTIVE SUMMARY

PLAN VISION

The approximately 14,000-acre San Pasqual Valley Plan Area, largely owned by the City of San Diego, lies within the San Dieguito River Basin, the fourth largest drainage basin in San Diego County. The Water Enterprise Fund was used to acquire the valley in the late 1950s for water-supply purposes. The plan area extends from the Hodges Reservoir eastward to Clevenger Canyon located at the narrow, eastern reach of the valley. The San Pasqual Valley, designated in a plan adopted in 1964 as an agricultural and open space preserve, has a population of only 426 people (source: 1990 Census of Population and Housing).

The importance of the valley, however, goes far beyond its role as a community in which relatively few people live and work. The valley functions as a natural boundary between the City and extensive urbanization to the north and is an integral part of the San Dieguito Watershed. Many of San Diego County's most sensitive habitats are found here. The valley contains agricultural resources that can be considered important from both an economic and a cultural standpoint. The valley also contains a large deposit of construction-grade sand that is important to the construction industry. Also present within the river valley is a rich diversity of cultural resources that represent the distinctive character of each era of the San Pasqual Valley's history. Ongoing studies suggest that two aquifers and the Hodges Reservoir will become increasingly important as sources of drinking water for City residents. And, the opportunity exists to establish regional-serving recreational uses within the valley while at the same time respecting its unique natural and man-made resources.

The vision of the San Pasqual Valley anticipated by the San Pasqual Community Plan (Plan) is therefore a pattern of land uses that are compatible with the needs of the region as a whole. Implementation of the Plan will ensure that:

- Water quality and quantity will be optimized within the aquifers and the Hodges Reservoir
- The rural character of the valley will be preserved in part through the retention of agriculture
- Riparian and sensitive upland habitats will be preserved
- Sand and mineral resources will be preserved and where feasible, utilized
- An open space park will be created that provides recreational opportunities for the San Diego region that are compatible with agricultural and habitat preservation

KEY COMMUNITY ISSUES

The San Pasqual Valley-Lake Hodges Planning Group has been meeting regularly with City staff since October 1993 to assist in the preparation of this plan update. City staff assigned to this plan update included liaisons with both the Water and Real Estate Assets Departments. Efforts focused on identifying important issues related to planning and development, and on establishing goals and recommendations that will guide the City as it reviews development proposals and makes land use decisions in the valley over the next ten to 15 years. Summarized below are the key issues:

Water Resources

Hodges Reservoir is currently a limited public water supply and is in the process of becoming a future source of water for City of San Diego. Pesticides, fertilizers, recycled groundwater used in agriculture, dairy farming and urban runoff from surrounding land uses within the Hodges Reservoir watershed may be compromising ground and surface water quality.

Source Water Protection Guidelines (January 2004) for New Development provide ways to ensure that Best Management Practices are implemented to reduce pollutants of concern from entering the reservoir. These include nutrients and organic carbons.

Agriculture

Agriculture provides economic benefits, however agricultural land uses potentially conflict with competing water resource, biological and cultural resource management and recreation goals for the valley.

Sensitive Resources and Open Space

The Lake Hodges/San Pasqual area is part of one of the largest continuous blocks of habitat in the City. The more important areas for conservation of endangered species are the natural areas around the Hodges Reservoir, the riparian habitat and the remaining undisturbed upland vegetation. Preservation of these habitats potentially conflicts with increased agricultural land uses in the valley.

Flood Control

Most agricultural land in the valley is within the 100-year floodplain and is subject to periodic damage from flooding. The agricultural leaseholders desire some degree of flood protection based on a hydraulic study. Potential impacts on groundwater recharge and downstream flooding must also be considered.

Mineral Resources

The San Pasqual Valley is the second largest source of construction-grade sand in western San Diego County. Sand mining operations potentially conflict with water resource, biological and cultural resource management and recreation goals for the valley.

Park and Recreation

The San Dieguito River Valley Regional Open Space Park Concept Plan has established goals for future park and recreation uses in the valley. The park is envisioned as a natural, open space park designed to interpret the significance of the valley's natural and man-made resources, and recreation uses must be designed to minimize impacts to these resources and to agriculture.

Visitor-Serving Uses

There are very limited sites at the edge of the plan area that are suitable for land uses other than agriculture and open space and that are compatible with the valley's largely rural character.

Cultural Resources

Due to its location in the San Dieguito River Valley, the planning area contains a wealth of prehistoric and historic resources, including hundreds of archaeological sites, five designated historic sites and numerous sites and structures with historic value that are potentially eligible for historic designation. Also, within the valley lies a rich agricultural heritage unique in Southern California.

Circulation

It is envisioned that the rural character of roads in the San Pasqual Valley will be maintained, even as the need develops to widen certain roadways to accommodate increases in traffic.

OVERALL GOALS

Based upon the issues identified, the following overall goals have been established for the valley:

- An adequate supply of useable ground and surface water, with Hodges Reservoir preserved as an expanded source of public water supply
- San Pasqual Valley maintained as an agricultural preserve
- A riparian corridor extending throughout the valley along the course of the San Dieguito River, Santa Ysabel and Santa Maria Creeks, as well as other biologically sensitive habitats preserved and managed as part of an interconnected regional open space system
- Agricultural lands protected from flooding where economically and environmentally possible, and all flood control measures beyond pilot channel maintenance according to a cost-benefit analysis

- A continuous multiuse corridor of walking, equestrian and bicycle trails encompassing the entire valley, and recreation facilities that do not compromise the valley's natural character and that are compatible with agriculture
- Visitor-serving activity in the valley limited to specific locations
- Preserved prehistoric and historic cultural resources and rural agricultural character
- A multimodal circulation system that adequately accommodates the needs of residents and visitors of the valley, as well as regional traffic, and that is compatible with its rural character
- Adequate community facilities and services to serve the residents and visitors of the valley

Introduction



- Purpose of the Plan
- Plan Organization
- How the Plan was Developed

INTRODUCTION

PURPOSE OF THE PLAN

The San Pasqual Valley Plan is the City of San Diego's adopted statement of policy for growth and development, as well as conservation, of the San Pasqual Valley Planning Area over the next ten to 15 years. The Plan describes a course of action considered to be advantageous to the City as a whole. The Plan is designed to influence and determine decisions regarding land use and development in the future. The Plan proposes specific goals and recommendations regarding the use and development of land within the valley, as well as the management of sensitive resources, and identifies how implementation of this Plan will affect public services and facilities such as roads and public safety.

PLAN ORGANIZATION

The San Pasqual Valley Plan consists of two parts: 1) this document which sets forth in text and graphics the goals, policies and specific proposals, and 2) a land use map on file in the Planning Department that depicts land use designations at a scale of one inch to 800 feet.

The San Pasqual Valley Plan text is organized as follows:

The **Introduction** describes the purpose of the Plan, its organization and development.

The **Planning Context** provides background on the planning area and its development history as well as a description of its urban setting, environmental influences and relevant citywide and regional planning issues. The **Elements of the Plan** set forth the goals for the future development of the plan area, the policies that will guide the actions of the City as it works toward achieving these goals, and more specific proposals describing how the policies will be applied to particular areas of the valley. These sections also contain tables of recommended actions to implement the policies and proposals of the Plan and a timeframe for implementation.

Additional background information is provided in the Appendices.

HOW THE PLAN WAS DEVELOPED

The update of the San Pasqual Valley Plan is a cooperative effort involving the San Pasqual Valley-Lake Hodges Planning Group, the Agricultural Advisory Board, the City of San Diego Planning Department, other City departments and governmental agencies. The Plan update was funded by the City of San Diego Water Utilities Department.

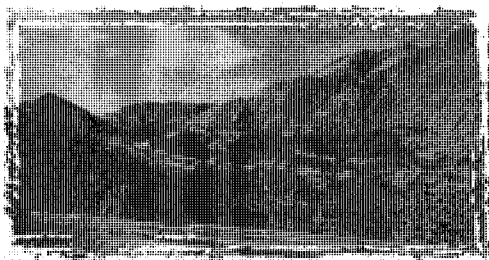
At the onset of planning efforts in October 1993, the San Pasqual Valley-Lake Hodges Planning Group met regularly and in subcommittees to identify issues that served as the framework for the development of the goals, policies and proposals of this Plan. Meetings were often conducted as forums around specific Plan issues. The planning group is comprised of leaseholders and representatives of other communities within a larger study

area that includes Escondido, Ramona, Rancho Bernardo and Del Dios. As a result of Planning Group input, extensive field work, numerous meetings with City staff and other governmental organizations, a careful review of existing planning documents and input received during a community forum/workshop held on January 26, 1994, a Summary of Existing Conditions, Planning Issues and Plan Update Goals was prepared in March 1994.

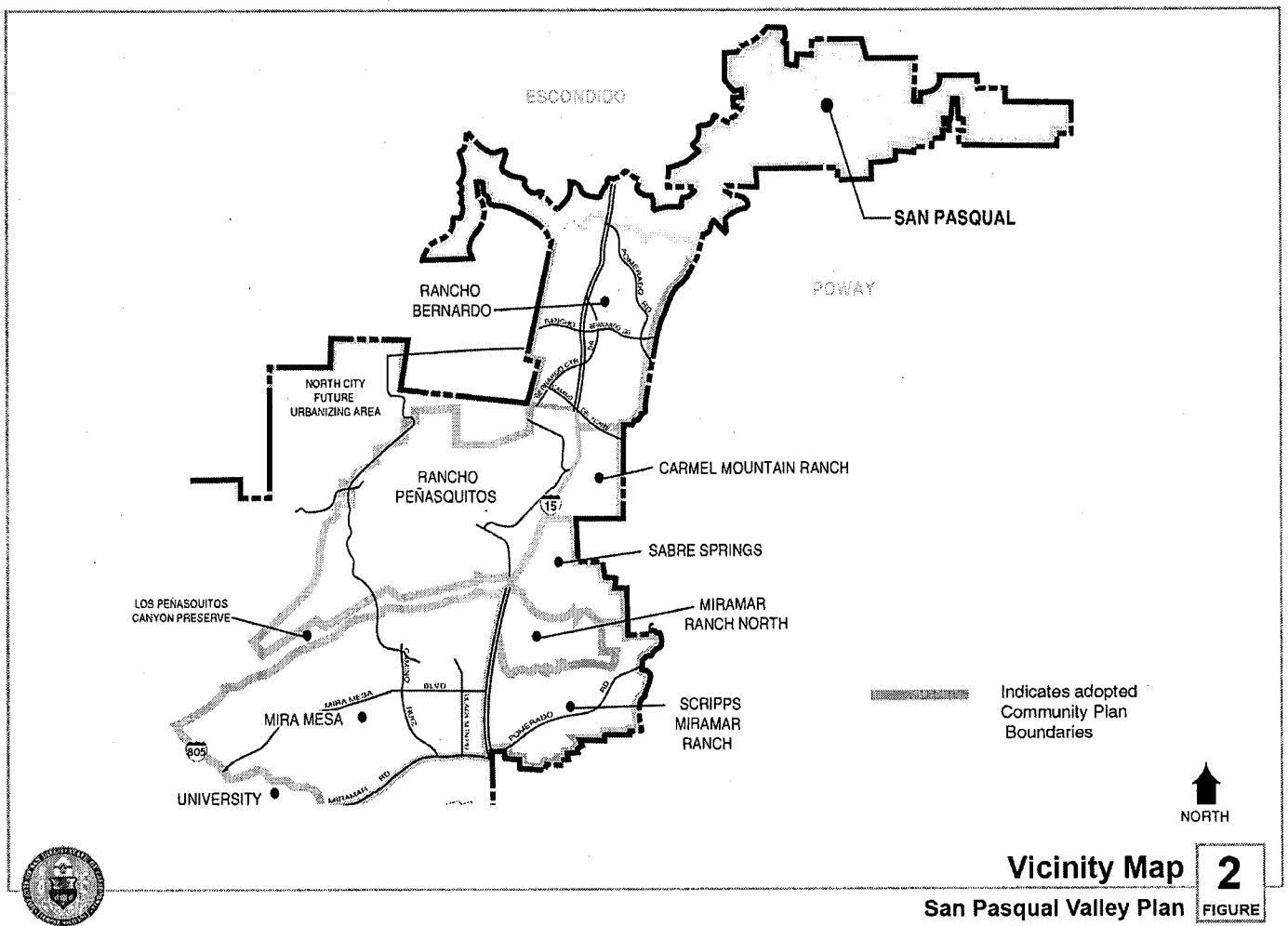
The summary report was used as the basis for an issues and goals workshop held with the Planning Commission in March 1994.

In July 1994 a draft plan update was published and distributed for public review. A revised draft plan which incorporated comments received during the public review period was distributed in December 1994. Two additional public workshops were held before the Planning Commission in January and March 1995. A noticed public hearing was held before the Commission in April 1995. The San Pasqual Valley-Lake Hodges Planning Group continued to review and provide input to the Plan through the workshop and public hearing process. The City Council adopted the Plan in June 1995.

Planning Context



- The Community Planning Area
- Development and Planning History
- Environmental Setting
- Urban Setting
- Demographics



PLANNING CONTEXT

THE COMMUNITY PLANNING AREA

The San Pasqual Valley Plan area is approximately 14,000 acres in area and is largely owned by the City of San Diego Water Utilities Department. The plan area includes approximately 3,000 acres located outside the City's municipal boundary proposed for future annexation (**Figure 14**). Agricultural land uses are prevalent and consist of various orchard, vine and field crops; dairy operations; and pasture land. The valley is located in the northern-most portion of the City of San Diego, 26 miles north of downtown San Diego, and is generally bounded on the north by the City of Escondido; on the east and west by unincorporated land within San Diego County; and on the south by the City of Poway and the Rancho Bernardo community.

DEVELOPMENT AND PLANNING HISTORY

The first major development in the valley was the construction of an irrigation canal for agriculture in 1853. A second irrigation canal was constructed in 1887. Although planned, a dam upstream in the Pamo Valley was never constructed and irrigation in the valley continued through the use of small canals and wells. By 1912, approximately 1,000 acres of field crops and orchards were under irrigation.

In 1918, the San Dieguito Mutual Water Company constructed the Hodges Dam, and water from the reservoir was transported to La Jolla and users in the lower San Dieguito Valley. The City acquired the reservoir in 1925. Although the City acquired the land necessary to raise the water level of the reservoir, the plan to enlarge the Hodges Reservoir in the 1940s, known as the "Super Hodges Project," was never implemented.

In 1954, construction of the Sutherland Dam near Ramona was completed by the City. However, in 1956, landowners in the San Pasqual Valley brought a successful lawsuit against the City over impacts of the Sutherland Reservoir and, as a result, the City's use of the Sutherland Reservoir was seriously restricted. Consequently, the City acquired the majority of the privately-owned riparian property in the San Pasqual Valley by the late 1950s.

In the early 1960s, land within the San Pasqual Valley was annexed to the City of San Diego, and the first San Pasqual Valley Plan was adopted in May 1964. That plan designated the valley as an agricultural and open space preserve. Approved as a guide for the development of the valley for the next 30 years, the plan was intended to expand the City's agricultural economy and to provide long-term, direct income from the agricultural use of these publicly-owned lands.

The Progress Guide and General Plan (General Plan) designates the San Pasqual Valley for agricultural, open space and resource-based park uses. The planning area is further identified as a Future Urbanizing Area in the General categories identified in the General Plan and is applied to large undeveloped areas within the City in order to protect them from premature development.

An update of the San Pasqual Valley Plan was prepared in the mid-1980s in response to extensive flood damage during the rainy season of 1978, and the need to implement measures to protect agricultural land from future flooding. The plan update was never adopted because of unresolved issues as a result of the pending mitigation plan for Pamo Dam. The mitigation plan proposed restoration of riparian habitat for the Least Bell's Vireo along Santa Ysabel Creek, creating a conflict between recommendations for flood control improvements, sand and gravel mining, and agriculture uses contained within the draft San Pasqual Valley Plan.

In 1995, the San pasqual Valley Plan was updated in response to issues raised during that plan update process, as well as to new planning issues which have emerged. New issues include water quality in the Hodges Reservoir and groundwater basin, the impacts of the Multiple Species Conservation Program (MSCP), and the San Dieguito River Valley Regional Open Space Park Concept Plan.

ENVIRONMENTAL SETTING

The San Pasqual Valley lies within the San Dieguito River Basin, the fourth largest drainage basin in San Diego County. The principal stream tributaries within the valley are Santa Ysabel Creek, Guejito Creek and Santa Maria Creek.

The San Pasqual Valley Plan Area extends from the Hodges Reservoir Dam eastward to Clevenger Canyon located at the narrow, eastern reach of the valley. The Hodges Reservoir landscape includes the broad, open waters of Hodges Reservoir and the contrasting steep, rocky slopes of the surrounding mountainous terrain to the north and south.

The area of the valley from Interstate 15 (I-15) to "the narrows" (see **Figure 4**) is dominated by groves of willows in the floodplain and distant views of hills and mountain ranges to the east. The valley is broad through much of this landscape, with moderate to steep hillsides bordering the valley to the north and south, and the primary uses within the floodplain are agricultural in nature.

That portion of the valley from the narrows eastward consists of a broad, open floodplain strongly defined by steep hillsides to the north and south. The valley floor consists of farms and fields, while the slopes are a combination of native scrub and hillside groves of citrus and avocado.

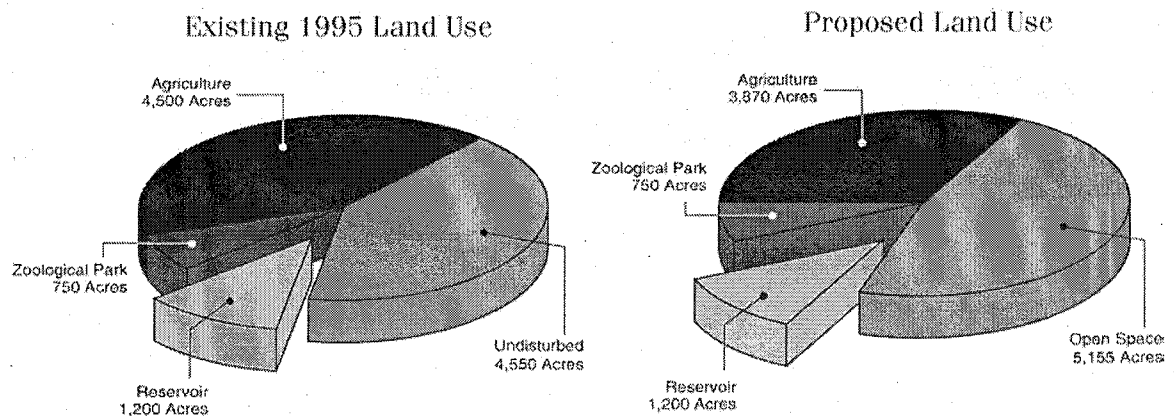
The Clevenger Canyon landscape begins at the narrow, eastern reach of the valley. Within this landscape, Santa Ysabel Creek has cut a deep, narrow and meandering course through the rugged terrain. This area is characterized by citrus and avocado groves, as well as by naturally vegetated steep hillsides and narrow canyons.

URBAN SETTING

Large portions of land surrounding San Pasqual Valley are highly urbanized, in particular land adjacent to the 1-15 corridor. A regional retail and community shopping center, North County Fair, is located at 1-15 and Via Rancho Parkway in Escondido, and urban residential densities occur in both Escondido and Rancho Bernardo. The village-like community of Del Dios is located on unincorporated land within the county along the western shore of Hodges Reservoir. Moving eastward from 1-15, surrounding adjacent development patterns change from urban densities to more rural estate development and open space. Land surrounding the eastern-most boundary of the valley is largely open space.

DEMOGRAPHICS

The valley is an agricultural preserve and does not have a large population. According to the 1990 Census of Population and Housing, the San Pasqual Valley (including some portions of the valley within the county) contained 426 people housed in 127 dwelling units. Household size in the plan area is 3.44 people/housing unit, compared to an overall City of San Diego figure of 2.61 people/housing unit. The median age of people living in the valley is 29.1 years. Median household income in the valley is \$31,354, compared to an overall City of San Diego median of \$33,686. The San Pasqual Valley has a proportionately higher population of people of Hispanic origin (43 percent) than the overall City (21 percent).



Plan Elements



- Water Resources
- Agriculture
- Sensitive Biological Resources and Open Space
- Mineral Resources
- Flood Control
- Park and Recreation
- Cultural Resources
- Circulation
- Community Facilities and Services

WATER RESOURCES

BACKGROUND

The San Pasqual Valley is located within the San Dieguito River Basin. The San Dieguito Basin drainage area is approximately 350 square miles and contains the San Dieguito River and its tributary creeks. The following major tributaries of the San Dieguito River are located within the San Pasqual Valley: Santa Ysabel Creek, Santa Maria Creek, Guejito Creek and Cloverdale Creek.

The San Dieguito River Basin contains two major surface water storage facilities, Sutherland Reservoir and Hodges Reservoir (both owned and operated by the City of San Diego Water Utilities Department). Hodges Reservoir is located within the western portion of the San Pasqual Valley Plan area and Sutherland Reservoir is located east of the plan area near Ramona. While Hodges Reservoir has the largest drainage area and the greatest local water supply potential among City reservoirs, with 33,500 acre-feet (AF) of storage capacity, it is only the sixth largest of the City's nine reservoirs. Considering that the original capacity of the reservoir was 37,500 acre-feet in 1919, and the latest capacity number of 33,500 acre-feet dates back to 1948, existing reservoir capacity may be less due to further siltation since 1948. There are currently no facilities in place to transfer this water to any of the City treatment plants. However, the City is obligated to deliver water from the Hodges Reservoir to the nearby San Dieguito and Santa Fe Irrigation Districts until the year 2019. Sutherland Reservoir contains 29,700 acre-feet of storage capacity and provides water to the Alvarado Treatment Facility serving the central part of the City.

The Water Utilities Department has prepared a Reservoir Management Study to evaluate opportunities for improving the efficiency and usefulness of the City's reservoir system. The study identified the potential to connect both the Hodges Reservoir and the San Vicente Reservoir to the Miramar Treatment Plant to provide critical emergency storage capacity for the Miramar Treatment Plant service area. The Miramar Treatment Plant serves the area north of Clairemont Mesa and is currently supplied only with imported water from the County Water Authority aqueduct. Should the imported water delivery be interrupted in an emergency, or become unreliable due to a water shortage, the available 5,000 acre-feet storage in Lake Miramar is inadequate to meet the area's short-term need. In order to improve the emergency storage capacity of the Miramar service area, the Water Utilities Department is planning to construct a pump station and pipeline to transfer water between the CWA aqueduct and Lake Hodges and ultimately to the Miramar Treatment Plant.

The San Pasqual/Hodges groundwater basins are also a significant natural water resource in the valley. The groundwater basins have a surface area of about 6,750 acres and the California Department of Water Resources has estimated the total capacity at 95,000 acre-feet, among the largest groundwater basins in San Diego County. The useable capacity of the basin is estimated at 48,000 acre-feet. Water in the groundwater basin is currently used for agricultural irrigation of City-leased property.

The San Pasqual Aquatic Treatment Facility was completed in 1993 and has the capacity to produce one million gallons of highly treated reclaimed water per day from wastewater. The City's Metropolitan Wastewater Department has studied the potential use for reclaimed water and has concluded that landscape irrigation and commercial/industrial use in Rancho Bernardo are the most feasible uses at this time. Other potential uses for reclaimed water are agricultural irrigation and recharge of the San Pasqual Groundwater basin.

The groundwater basin could also be recharged with the excess stormwater runoff that is not being captured in Hodges or Sutherland Reservoirs. Groundwater storage may also be efficiently used to store periodically available surplus imported water. Conceptual facilities identified in the Reservoir Management Study include a groundwater recharge basin, injection and extraction wells and connecting subsurface pipelines.

An evaluation of water quality in the Hodges Reservoir and the groundwater basin is being conducted by the Water Utilities Department as part of a Watershed Sanitary Survey project required for all City reservoirs according to state law. Results from this survey will drive the development of a watershed management plan to include best amendment practices and will also address issues relating to future land uses in the entire watershed of Hodges Reservoir, including the San Pasqual Valley.

GOALS

- An adequate supply of useable ground and surface water
- Improved water quality in the Hodges Reservoir and the San Pasqual groundwater basin
- Hodges Reservoir preserved as an expanded source of public water supply

POLICIES

1. The City shall develop the valley's water resources for municipal water supply. Water resource development will require new facilities in areas designated for agriculture and open space.
2. The City shall maintain the water quality in the Hodges Reservoir and the San Pasqual groundwater basins at a level consistent with municipal water supply needs.
3. The City shall regulate activities that are proven to be a detriment to the maintenance of useable water quality in the groundwater basin and Hodges Reservoir.

SPECIFIC PROPOSAL

Re-evaluate San Pasqual Valley activities after completion of the Watershed Sanitary Survey in 1996. Activities proven to be detrimental to maintaining useable water quality should be regulated. These regulations should be based upon State Regional Water Quality Control Board standards and Soil Conservation Service's best management practices.

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Re-evaluate land uses upon completion of watershed sanitary study; revise leases		•		Real Estate Assets, Water Utilities and Planning Departments	N/A	Proposals 1, 2
Develop best implementation practices		•		Real Estate Assets and Water Utilities Department	Water Utilities Department	Proposal 2

AGRICULTURE

BACKGROUND

The 1964 San Pasqual Valley Plan designates the valley primarily for agricultural use. In 1970, the City Council adopted a resolution designating that the valley be maintained as an agricultural preserve. The City has pursued a program to develop the valley for agricultural uses through lease agreements with agricultural enterprises. In fact, agricultural leases are the predominate land use in the San Pasqual Valley and comprise approximately 30 percent of the 14,000-acre plan area. Agricultural activities within the valley include livestock grazing, horse stables, dairy farming, orchard cultivation and the growing of nursery stock. These agricultural enterprises have a positive impact on the local economy—the gross economic value of products and services produced by the agricultural lessees is approximately 30 million dollars annually.

Retail activity in the valley occurs in conjunction with agriculture and includes the sale of locally grown produce and nursery stock. The direct sale of the valley's agricultural products provides the customer an alternative shopping experience in a unique setting. The farmer benefits by having access to the area's large population.

The value of the San Pasqual Valley for agriculture is based on a number of factors, including water, climate, soils and flood control.

Water

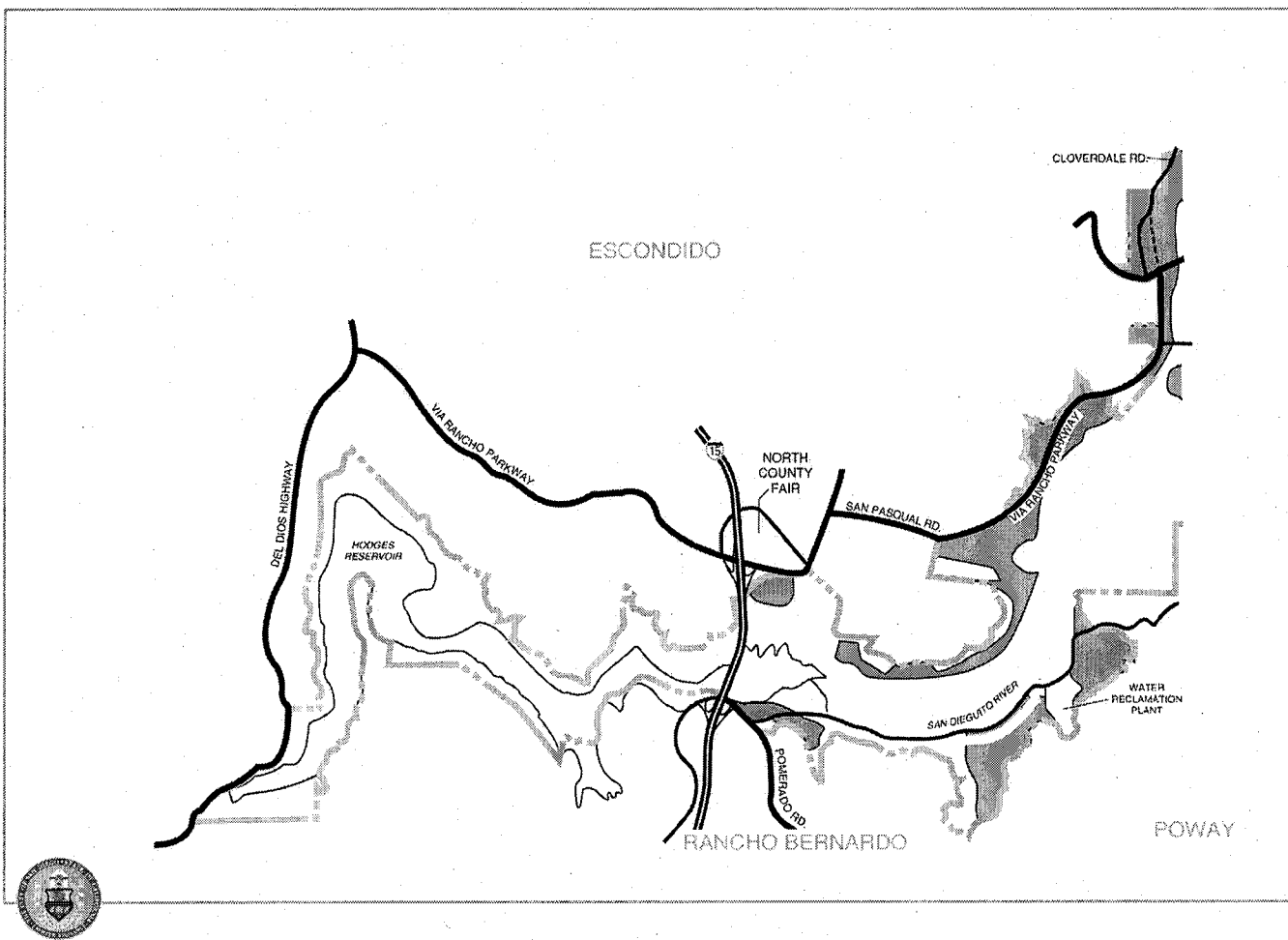
The availability and cost of water are the main factors that determine the viability of agriculture in an arid environment like San Diego. The San Pasqual groundwater basin provides the valley with a reliable water source. However, recharge of the groundwater basin is unreliable in dry years while localized usage has been increasing; therefore, the potential exists for future water shortages.

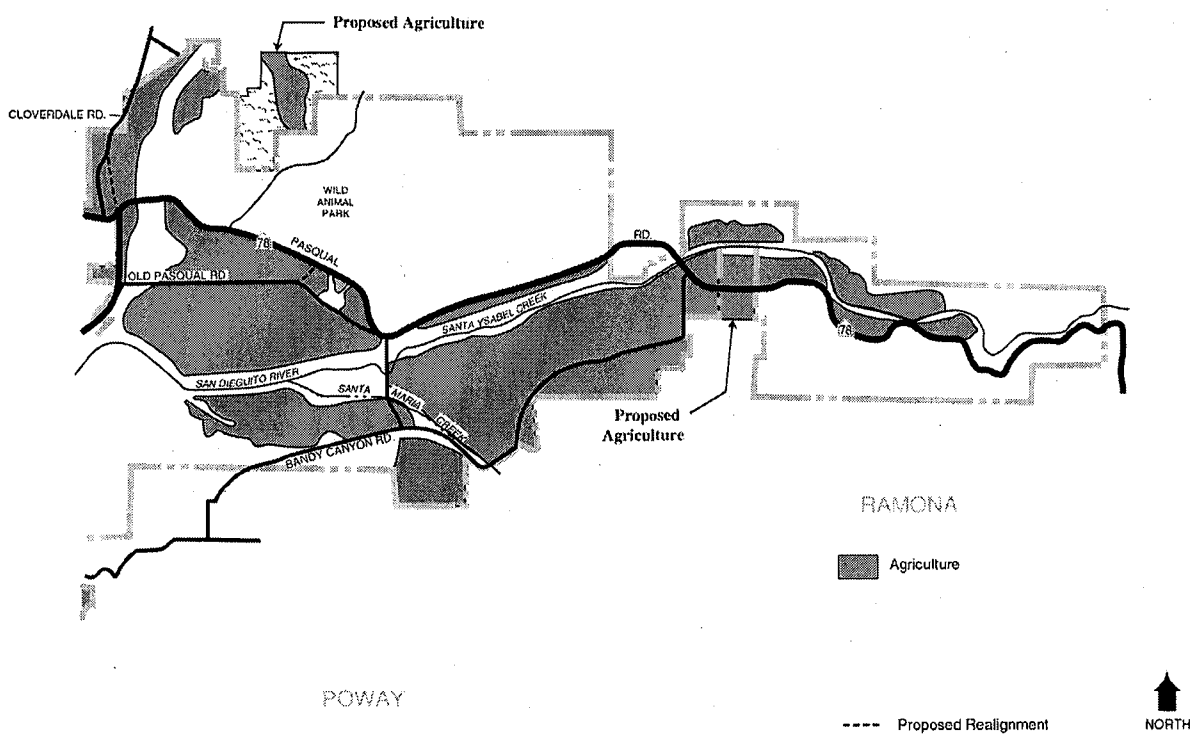
The City has made groundwater available to the leaseholds for the cost of developing wells plus the cost of pumping the water (which is typically less than the cost of imported water).

Water quality is of equal concern to agricultural operations. The groundwater quality in the eastern portion of the valley generally remains high due to inflows from upstream, while water quality in the western portion of the valley is compromised by high levels of salts and nitrogen.

Climate

The climate in the San Pasqual Valley is particularly suited for agricultural crop production. The valley is both influenced by coastal and interior climatic conditions. The coastal influence moderates winter cold, while the interior influence increases summer heat, giving the valley a long growing season suitable for a wide variety of crops.





Proposed Agricultural Land Use
San Pasqual Valley Plan

3
 FIGURE

Soils

The most valuable soils are found in the upper San Pasqual Valley and in the floodplain above Hodges Reservoir. Generally, these soils are characterized as well drained, nearly level to moderately sloping, and range from loamy sand to clay. They are well suited for growing avocado, citrus, flowers and truck crops. The valley also contains soils that are low in fertility due to poor or excessive drainage and low levels of organic matter. Some of the poorer soils in the valley have been successfully utilized for growing nursery stock.

Flood Control

Historically, some measure of flood control has existed in the valley and continued flood control is considered important by the farmers to the maintenance of agriculture. The farmers in the valley believe that the necessary width of flood channels to provide adequate flood management need to be based upon identified risk assessments from hydraulic modeling, and that a plan to capture and remove sand and sediment from the riparian open space corridor is also required. If properly designed and implemented, flood management can be accomplished in a manner that is compatible with the preservation of natural resources, water quality and agriculture. Refer to the **Flood Control Element** of this Plan for a complete description of goals, policies and specific proposals.

Housing

Housing needs in the San Pasqual Valley relate primarily to the provision of housing for the farmworkers employed by the farms and nurseries in the Valley. There are 39 units of housing dispersed throughout the San Pasqual Valley east of Hodges Reservoir. All of these housing units are under City ownership. Some of these housing units are included in the agricultural leases while others are leased separately. Farm labor is divided into two overlapping groups: permanent workers and day laborers who are employed on a seasonal basis during peak periods. Permanent workers include skilled and professional staff that receive higher pay than other farm workers and therefore do not have the same limitations in housing choice.

Housing opportunities exist outside the valley in the neighboring communities of Escondido, Rancho Bernardo and Ramona. However, there is a significant population of day laborers in North San Diego County living in illegal, temporary encampments. These encampments lack indoor plumbing, heating and cooking facilities. In order to address the needs of permanent employees who are inadequately housed, the City Council has adopted a series of policies and incentives to promote low-income housing for farm workers. These policies and incentives are based on the following considerations:

- Agriculture, even with modern mechanization, still requires significant amounts of labor
- Labor requirements can be especially intensive during planting and harvesting periods
- Due to the prevailing wages and the cost of housing, few agricultural workers can afford typical housing near agricultural sites

- It is unlikely that it would be economically viable for agricultural businesses to provide housing for all workers
- “Acceptable housing” must be clearly defined since so many perspectives exist

Visitor-Serving Uses

Most commercial activity in the San Pasqual Valley is related to tourism, education or recreation. These uses include the Orfila Winery, which provides wine-tasting and catering facilities, and the San Diego Wild Animal Park operated by the zoological society on 1,800 acres of land leased from the City. The Wild Animal park operates through a lease agreement with the City that predates many regulatory requirements. Although the primary goal of the zoological society is the preservation, care and study of endangered wildlife, the Wild Animal Park also operates visitor facilities, provides exhibits, restaurants, concessions, parking areas, as well as the Center for the Reproduction of Endangered Species and veterinary hospital facilities. In fact, the park is the third largest tourist attraction in the county, drawing 1.4 million visitors a year.

The Escondido Golf Course and the Hodges Golf Improvement Center are commercial recreational uses that lease over 55 acres of land from the City.

The forecasted attendance prepared by the Wild Animal Park anticipates that the current number of visitors per year will double in 50 years. The park plans to expand the animal exhibit area and related facilities to accommodate the expected increase in attendance. Currently, the park does not provide overnight accommodations for visitors.

GOALS

- San Pasqual Valley maintained as an agricultural preserve
- Agriculture practiced to minimize impacts on water quality
- Land use conflicts between agriculture and other land uses minimized
- Agricultural lands protected from flooding where economically and environmentally possible
- Limited retail activity in conjunction with agriculture
- An adequate supply of farm worker housing
- Enhanced visitor enjoyment of the valley in conjunction with the Wild Animal Park and Orfila Winery while minimizing impacts on the valley’s rural character
- Non-agricultural uses reverted to agricultural lands at the time when these uses are discontinued

POLICIES

1. Agricultural activity should be managed to minimize soil erosion and minimize the release of contaminants into the groundwater basin and Hodges Reservoir.
2. Prohibit or regulate local activities that are proven to be a significant detriment to the maintenance of useable water quality in the groundwater basin and Hodges Reservoir.
3. The City shall work with leaseholders to develop economically and environmentally sound approaches to providing the minimum necessary flood control to support agriculture within the San Pasqual Valley.
4. Retail activity in areas designated for agriculture should be limited to uses that are related to agriculture such as the sale of locally grown farm products.
5. The City shall encourage the provision of farmworker housing through public subsidies or incentives to the lessees. Leasehold incentives could include alternative means of meeting minimum code requirements and payment of housing impact fees with public funds.
6. Dwellings shall be maintained in a habitable condition.
7. Visitor serving uses shall be designed to minimize the impacts on the valley's rural character. The City shall employ the design and development criteria contained in **Appendix E** of this Plan, as appropriate, to determine whether a project is compatible with the rural agricultural character of the valley.
8. Agricultural activities are encouraged to provide for educational experiences which demonstrate the agricultural operations of the San Pasqual valley.

SPECIFIC PROPOSALS

1. Existing leases should be amended upon renewal to include best management practices as recommended by the U.S. Department of Agriculture, Soil Conservation Service.
2. Eliminate from future leases uses that are identified by ongoing water quality studies as incompatible with prudent watershed management practices.
3. Inspect the City-owned houses to ensure that they continue to meet building code standards and have adequate septic systems. Where further repairs and improvements are necessary, work with the lessees, the Housing Commission and other appropriate agencies to offer financial assistance and rent subsidies to make the repairs economically feasible, while still retaining affordability for the occupants.
4. Negotiate provisions for farmworker housing, when practical, into new leasehold agreements or as they come up for renewal. Work with the Housing Commission and/or other appropriate agencies to design and facilitate financing of the housing.

5. Study economically and environmentally sound approaches to providing the minimum necessary flood control to support agriculture within the San Pasqual Valley.
6. Designate the San Diego Wild Animal Park lease area north of SR-78 for zoological park and open space use. Development should proceed according to the park's Long Range Facilities Plan (LRFP) and will include animal exhibit and holding facilities, Center for the Reproduction of Endangered Species, animal care facilities, veterinary hospital, food and gift concessions, lodging facilities and entertainment uses. The Wild Animal Park expects that their LRFP will take at least 50 years to reach completion.

The Wild Animal Park processed a Resource Protection Ordinance (RPO) permit in order to implement the initial phase of their plan as well as the policies of the **Sensitive Resources and Open Space Element** of this Plan. This RPO applies to existing park development and a small portion of their undisturbed leasehold as illustrated on **Figure 10**.

The completion of development according to their Long Range Facilities Plan will require expansion into undisturbed areas. Expansion into undisturbed areas will require an amendment to their RPO. Future expansion should be based upon updated biological mapping conducted by the Wild Animal Park, and expansion should be limited to the less sensitive portions of the leasehold.

8. Designate approximately 15 acres encompassing the knoll where the Orfila Winery and gift shop building and parking and picnic areas are located for agriculture.
9. The Hodges Golf Improvement Center site should revert back to an agricultural use when that lease expires or the use is discontinued, whichever comes first.

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Amend leases to include best management practices		•		Real Estate Assets Department	N/A	Proposals 1, 2
Inspect City-owned houses to ensure building code compliance		•		Development Services Department, Housing Commission	Housing Commission	Proposal 3
Encourage provision of farmworker housing in new or renewed leases when practical		•		Real Estate Assets Department, Housing Commission	N/A	Proposal 4
Study economically and environmentally sound approaches to providing the minimum necessary flood control		•		Leaseholders, Water Utilities Department	Undetermined	Proposal 6

SENSITIVE BIOLOGICAL RESOURCES AND OPEN SPACE

BACKGROUND

The Lake Hodges/San Pasqual Valley area is a significant open space resource providing contrast with the extensive urbanization located on either side of the valley in Escondido and Rancho Bernardo. The lack of urban development throughout such a large land area is particularly sustaining to wildlife.

The San Diego region contains many plant and animal species that are adapted to highly specialized conditions. This biodiversity is easily threatened by development in areas of native habitat, whereby many species are becoming threatened with extinction. The San Pasqual Valley contains a significant block of undisturbed native habitat containing rare or threatened plant and animal species.

Areas containing important biological resources are located around Hodges Reservoir, the San Dieguito River and its tributary creeks, and the upland areas including the steep slopes above the valley. San Pasqual's sensitive biological resources consist of the following native plant communities and habitat types (**Figure 4**). All of these resources require special attention due to their uniqueness, rarity, specialized biological function, high degree of diversity, or provision of habitat for species that qualify for listing under the federal Endangered Species Act.

Chaparral

A tall, broad-leaved shrub community with thick vegetation often found on moist north and east facing slopes. It is valuable as a wildlife food source and cover.

Coastal Sage Scrub

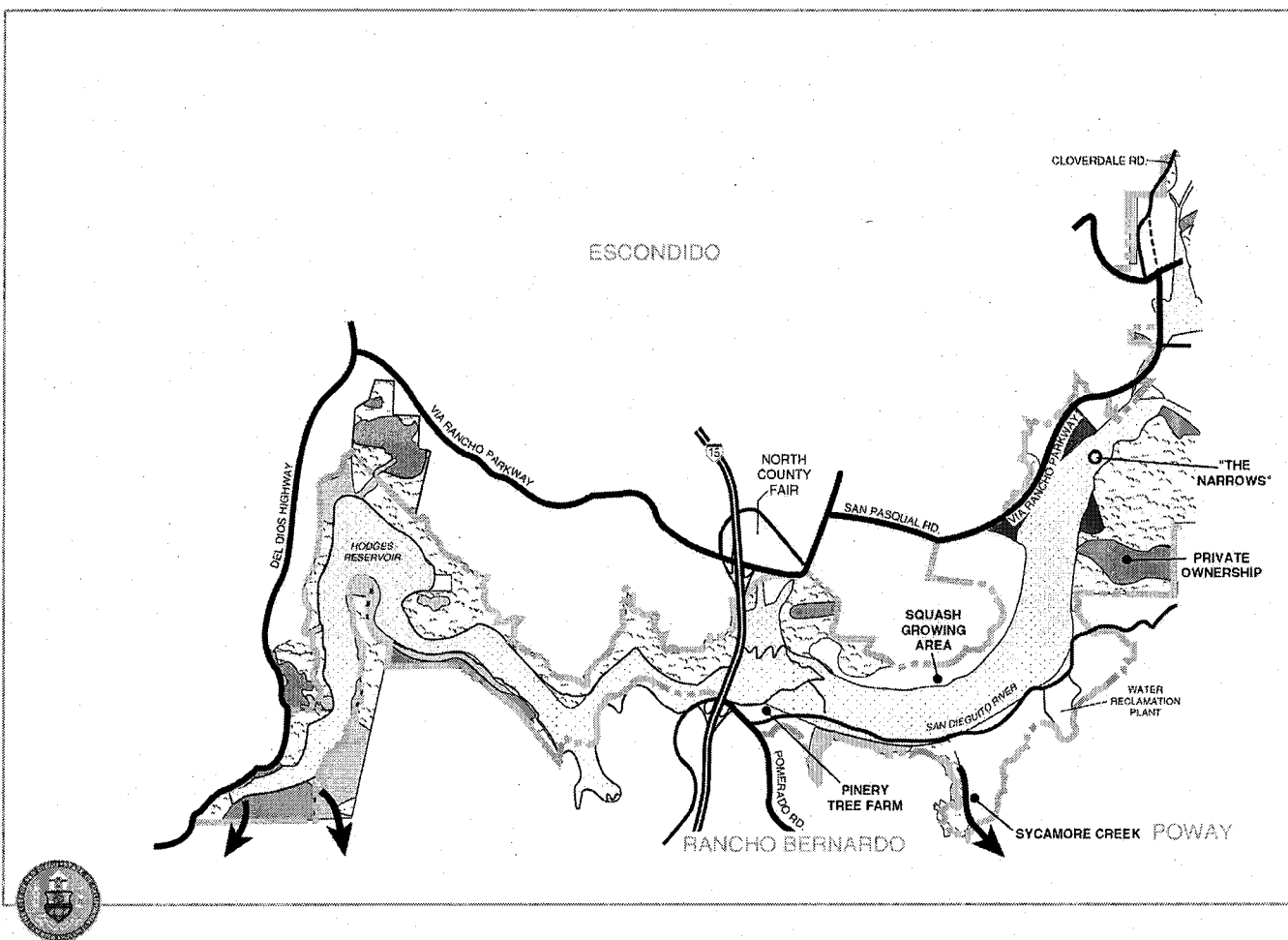
A low-growing, open, soft-wooded sub-shrub plant community that is well adapted to the drier conditions of south and west facing slopes and mesa tops. Due to the regional decline of this plant community and of the species that inhabit it, coastal sage scrub is considered highly sensitive and is a high priority for preservation. Coastal sage scrub provides habitat for the federally-threatened California gnatcatcher.

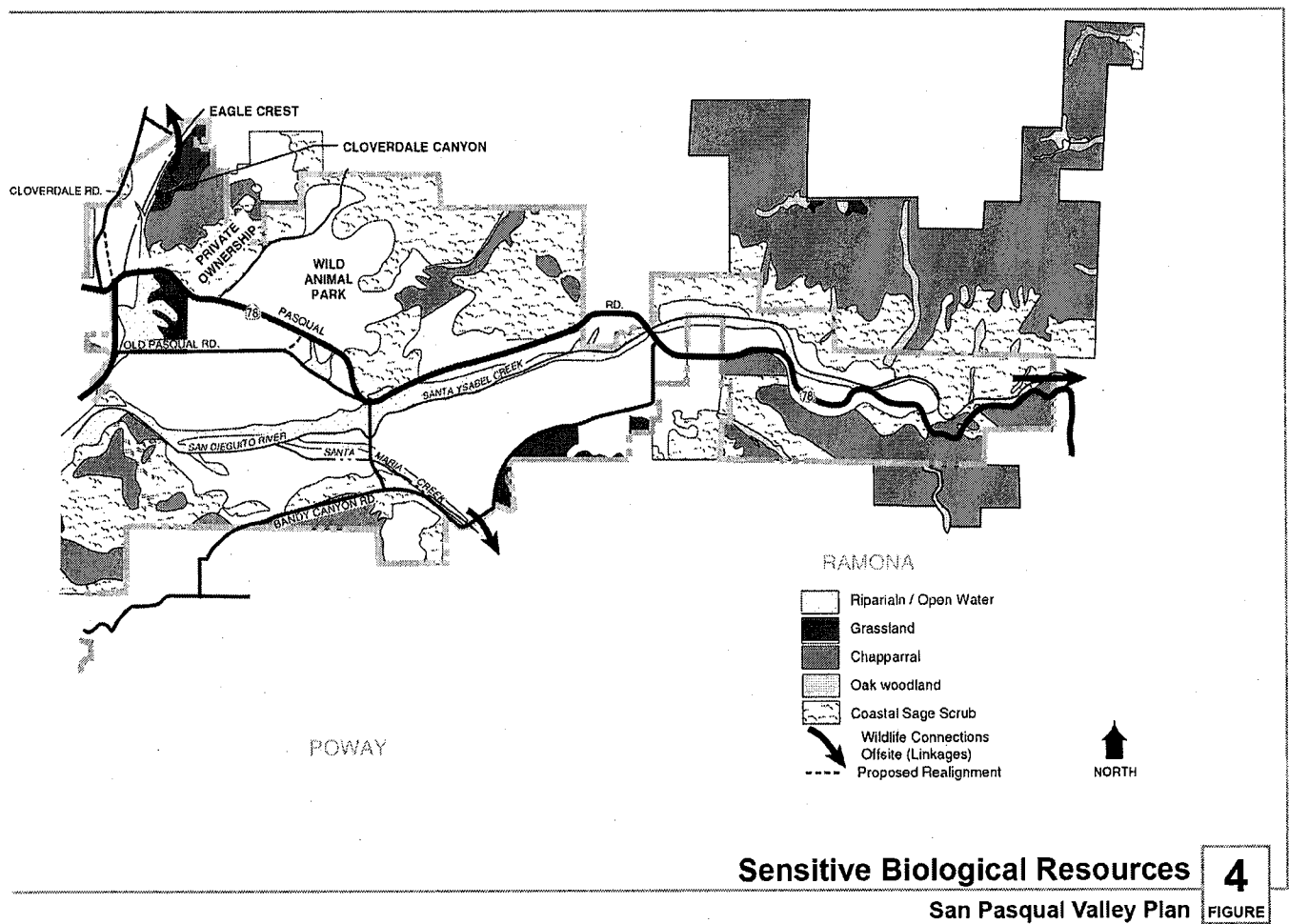
Oak Woodland

An uncommon, extremely slow-growing plant community considered highly sensitive due to its value to wildlife, and a priority for preservation. Oak woodlands are found in the valley's tributary canyons along lower slopes and canyon bottoms.

Grasslands

Important foraging areas for birds, insects, reptiles and mammal species, native grasslands also support several sensitive annual plants and are considered highly sensitive and a high priority for preservation.





Riparian

Plant communities occurring along stream banks and in creek beds where water is available. Riparian vegetation requires the presence of water, either above or below ground, during a significant portion of the growing season. Riparian areas provide food, cover, shade, water and nesting areas for wildlife and also act to control erosion and sedimentation. The federally-endangered least Bell's vireo nests in the willow groves found along the San Dieguito River and its tributary creeks. Considered wetlands, riparian habitat is critical to the survival and movement of wildlife and is therefore a high priority for preservation.

Wildlife Connections

Wildlife movement corridors are an important element of viable habitat that are considered sensitive according to the City's Resource Protection Ordinance (RPO). When these corridors are severed by development or roads, habitats are fragmented. This isolation affects some species more than others, but can result in declining wildlife populations. It is, therefore, important to identify the location of active or potential corridors and to maintain suitable connections between open space.

In the San Pasqual Valley, wildlife movement occurs between the watercourse and habitat located on the slopes of the valley. Although some wildlife movement will pass through agricultural areas (especially orchards), the cover provided by riparian vegetation is more conducive to wildlife movement. Therefore, it is important to restore riparian vegetation in areas where it has been disturbed by agriculture or other activity. In portions of the watercourse, the floodway has been filled to reclaim land for agricultural use. Wildlife movement is more difficult in areas where the creek channel is "pinched" and devoid of plant cover.

Although most land in the San Pasqual Plan area is under public ownership, there are eight A-1-10 zoned parcels containing approximately 550 acres that are privately owned. These parcels are located on the steep slopes and ridgetops above the valley. Development of private property that contains sensitive resources is regulated by the City's Resource Protection Ordinance (RPO). RPO is designed to protect sensitive native biological species and their habitats, steep hillsides, 100-year floodplains, wetlands, prehistoric and historic sites. Ongoing agricultural activity in areas that have been farmed within the last five years is exempt from RPO.

In addition, State and Federal agencies such as the U.S. Fish and Wildlife Service, the Army Corps of Engineers, and the California Department of Fish and Game have jurisdiction over development in wetlands, and habitats for threatened or endangered species.

The General Plan recognizes the importance of maintaining a viable ecosystem, the conservation of endangered species, and the management of land for the protection of natural resources.

The City is currently developing a Multiple Species Conservation Program (MSCP) to protect key habitat areas and wildlife corridors and to meet the requirements of the federal

and state Endangered Species Acts by preserving rare, threatened and endangered species in the San Diego region. The goals of the MSCP are to maintain biodiversity in the region and thereby eliminate causes of species extinction; facilitate permit issuance and mitigation of public and private sector land development and construction projects; and maintain a balance between preservation of natural resources and growth of the regional economy.

The land around Hodges Reservoir up to "the narrows" within the San Pasqual plan area is one of the four "cornerstone" areas being considered for inclusion in the MSCP preserve system. The cornerstone lands constitute the City's initial commitment of lands to the preserve system for which the City will receive mitigation "credit."

The draft MSCP Plan recommends that the most important areas for conservation are those natural areas around Hodges Reservoir, the riparian habitat along the San Dieguito River and its tributaries through San Pasqual Valley, and the naturally vegetated slopes above the river valley. The majority of the riparian habitats in the river valley provide excellent opportunities for restoration and enhancement of the wildlife corridor through the valley. Conserved lands in the Hodges Reservoir/San Pasqual Valley area will be the cornerstone for a natural east/west open space corridor within the San Dieguito River Valley and San Pasqual Valley.

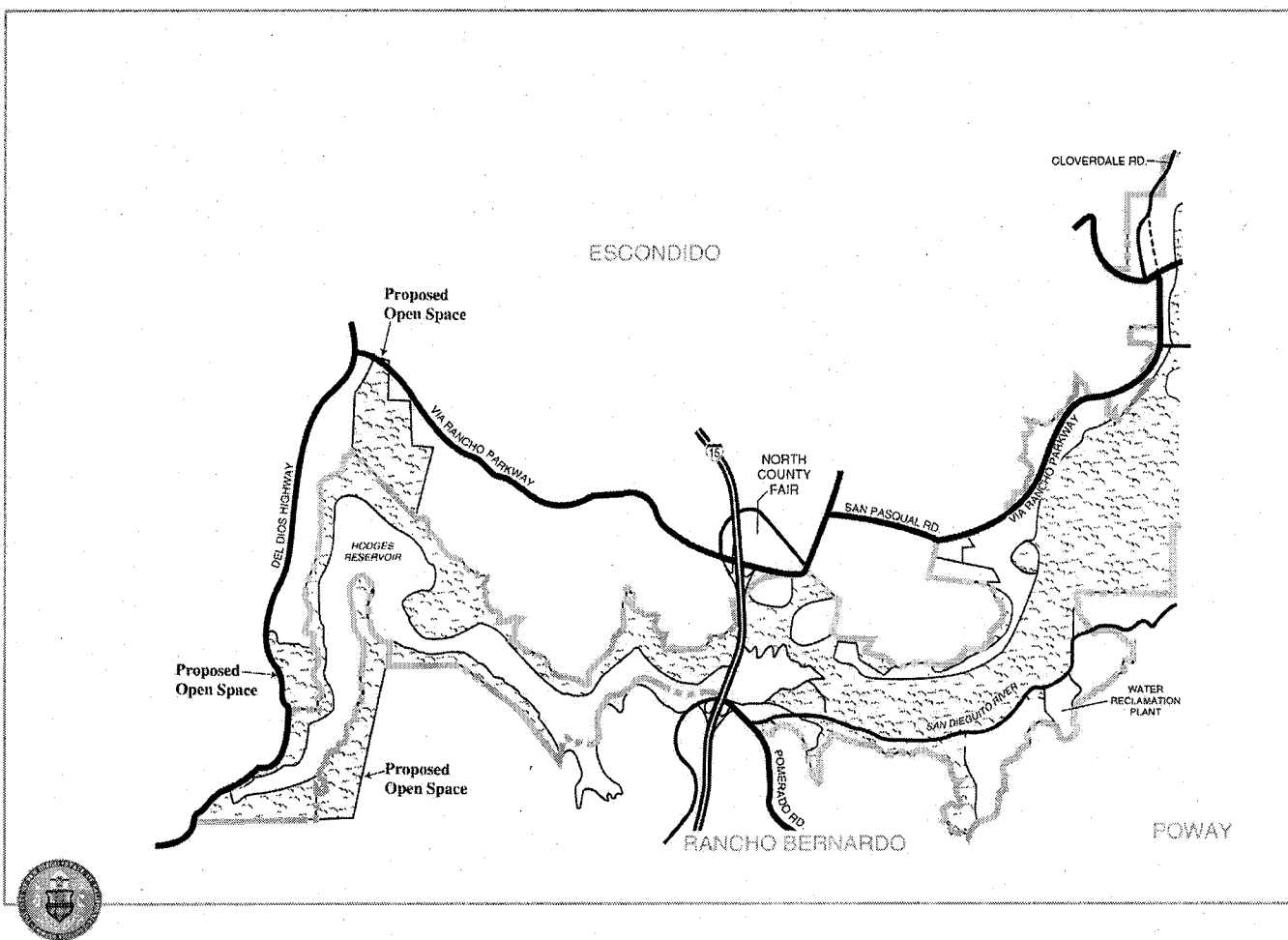
GOALS

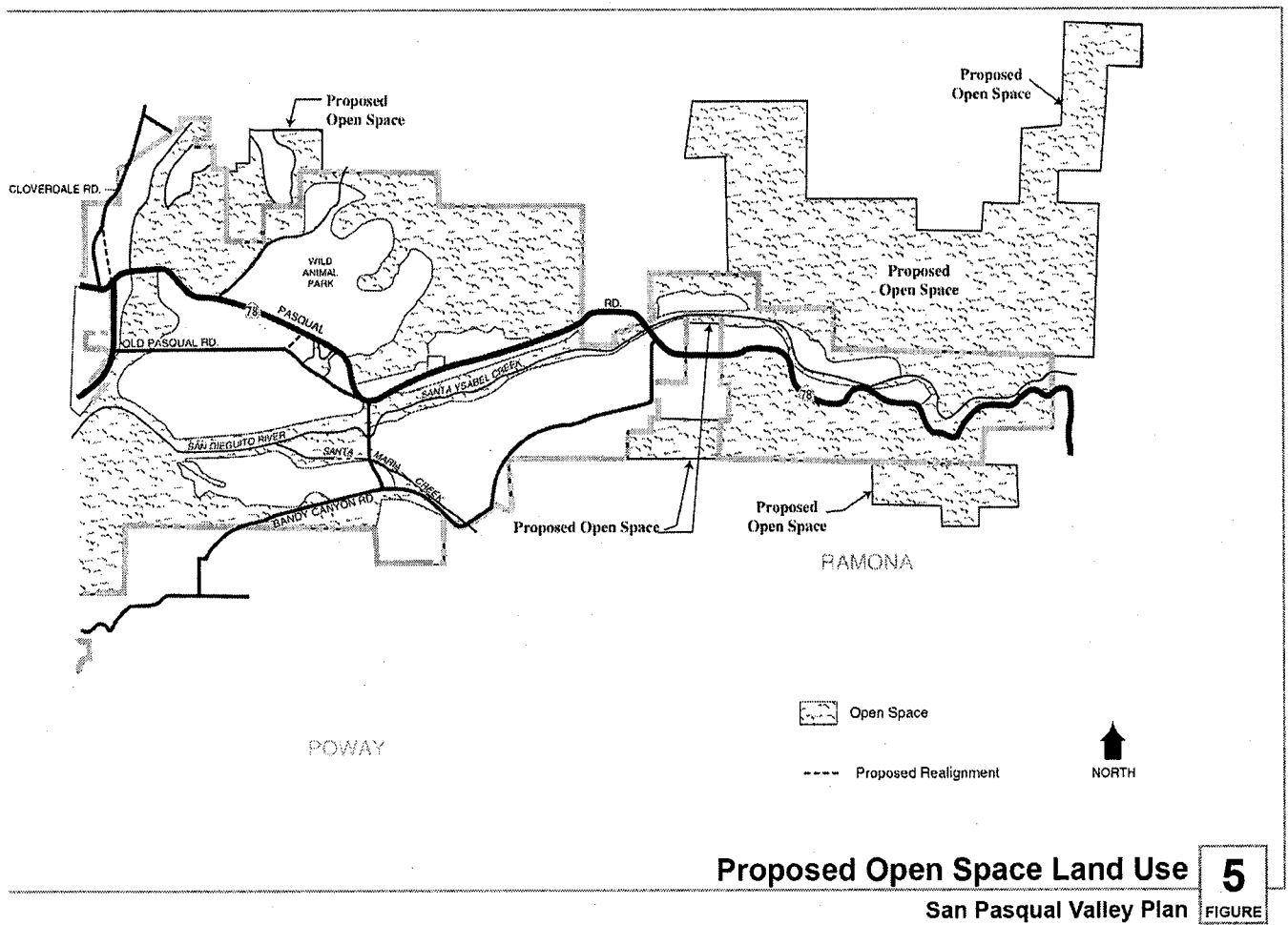
A planning area-wide open space system with the following characteristics:

- Preserved riparian corridors along the San Dieguito River and its tributaries, and improved riparian vegetation through a more natural flood cycle and limited flood improvements
- Preserved sensitive upland habitats
- Vital naturally-vegetated linkages provided to the surrounding regional open space system

POLICIES

1. The undisturbed oak woodland, chaparral and coastal sage scrub habitats throughout the valley shall be preserved as open space.
2. Native riparian vegetation along the course of the San Dieguito River and its tributary creeks shall be preserved, or restored where disturbed.
3. A wildlife connection shall be preserved along the watercourse of the San Dieguito River. Connections to upland habitat areas shall be preserved (or restored where interrupted) following the river's tributary creeks.
4. Areas designated for open space preservation on publicly-owned land shall be protected from environmentally destructive activity. However, construction and maintenance activities for flood control projects and for municipal and agricultural water production purposes shall be permitted within open space.





5. Periodic sand removal in the riparian open space corridor beyond the maintenance of the 40-foot pilot channel can be considered only if determined to be beneficial to the riparian corridor as part of the implementation of an approved restoration plan.
6. Sensitive habitat area that is degraded by human activity, or compromised by the presence of exotic or invasive plant species shall be restored, as feasible, for mitigation credit.
7. The open space designated by this Plan shall also be included in a Multiple Species Conservation Program (MSCP) preserve.
8. Lease boundary adjustments needed to implement specific proposals of this Plan should minimize additional costs to the City or financial hardships to the leaseholder. Typically, lease boundary adjustments will occur when leases are renewed.
9. Habitat protection or restoration proposals for mitigation should be based on the specific proposals of this Plan.

SPECIFIC PROPOSALS

General

1. Designate the following areas containing undisturbed native vegetation as open space (**Figure 5**): the shoreline around Hodges Reservoir; the riparian corridor formed by the San Dieguito River and its tributary creeks; and the steep slopes in the San Pasqual Valley.
2. Exclude riparian open space from City leases as those leases are renewed or renegotiated. Agricultural activity (including livestock and equipment) will not be permitted in riparian open space. At a minimum, the City will demarcate the riparian open space corridor with survey markers. Signage, or additional barriers such as fencing, should be used to restrict public access where required.
3. Retain the existing Agricultural A-1-10 zoning on land designated for open space. An open space zone intended for preservation of natural open space may be adopted in the future as a result of the City's zoning code update.
4. Complete a biological survey for the parcels identified in **Appendix D** if they are annexed to the City. At a minimum, the portions of these parcels that contain sensitive biological resources shall be designated for open space preservation.
5. Any new or renewed lease for dairy or cattle grazing operations adjacent to riparian habitat will include a requirement to trap brown-headed cowbirds, a nest parasite of the threatened least Bell's vireo.
6. Prepare a plan for the eradication of exotic plant species, such as tamarisk and arundo, from the San Dieguito River and its tributary creeks as part of a riparian woodland mitigation project.

Reach 1

7. Preserve as open space the undisturbed upland vegetation and riparian areas along the shoreline of Hodges Reservoir for future use as a “cornerstone” area in the MSCP preserve system.

Reach 2

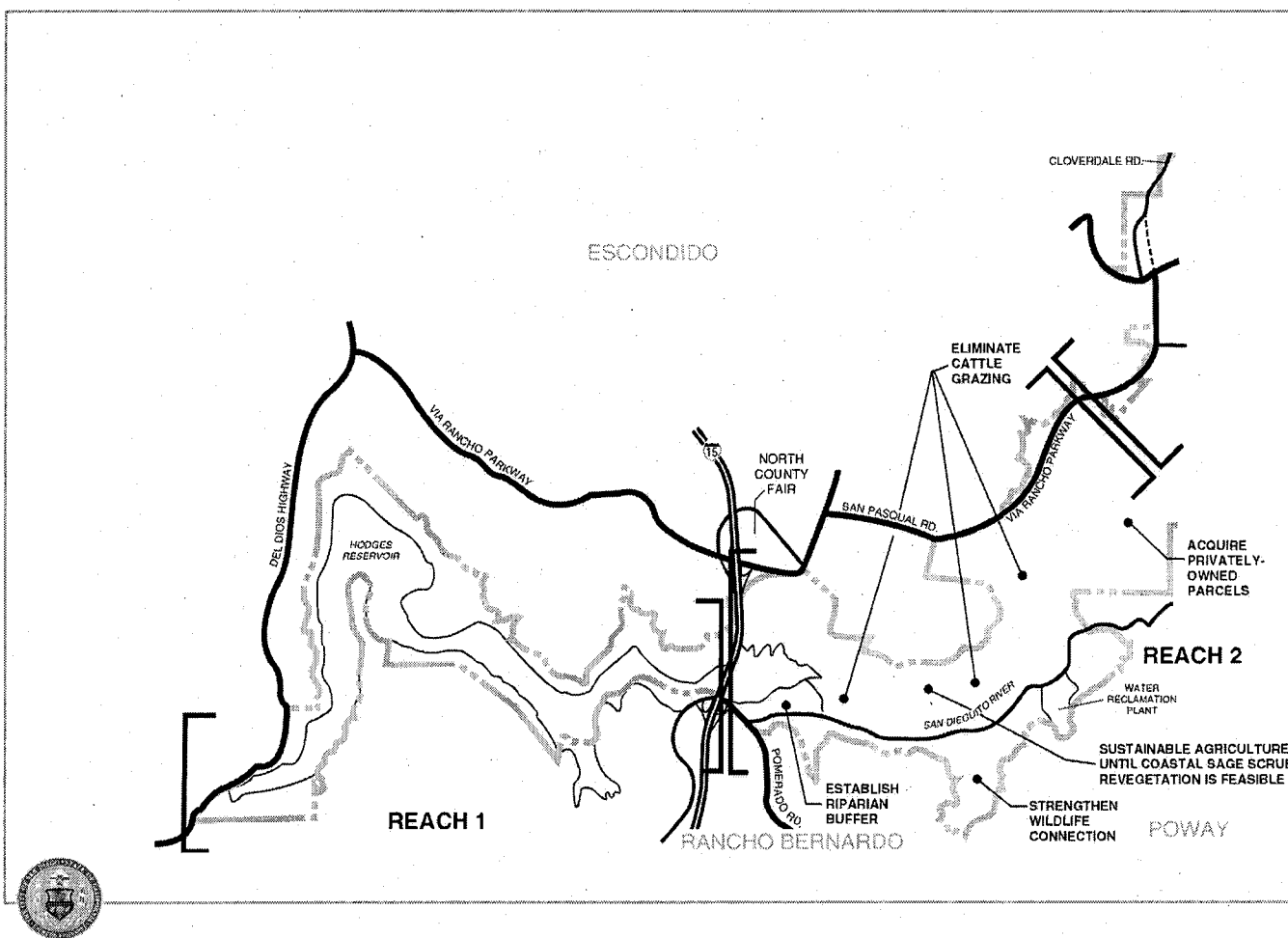
8. Establish a riparian buffer from the edge of the existing riparian habitat on the Pinery Tree Farm lease located between Highland Valley Road and Hodges Reservoir. The width of the buffer should be based on the relative ability for riparian vegetation to regenerate and the potential impacts of existing agricultural uses or future commercial use on the least Bell's vireo population.
9. Strengthen the wildlife connection along Sycamore Creek to the Blue Sky Ranch open space preserve in Poway. The flood channel should be modified to improve the corridor width and create a more natural channel bank. The berm on the eastern edge of the creek will need to be eventually modified and potentially moved to create a shallower slope ratio and to provide flood control for agricultural uses to the east.

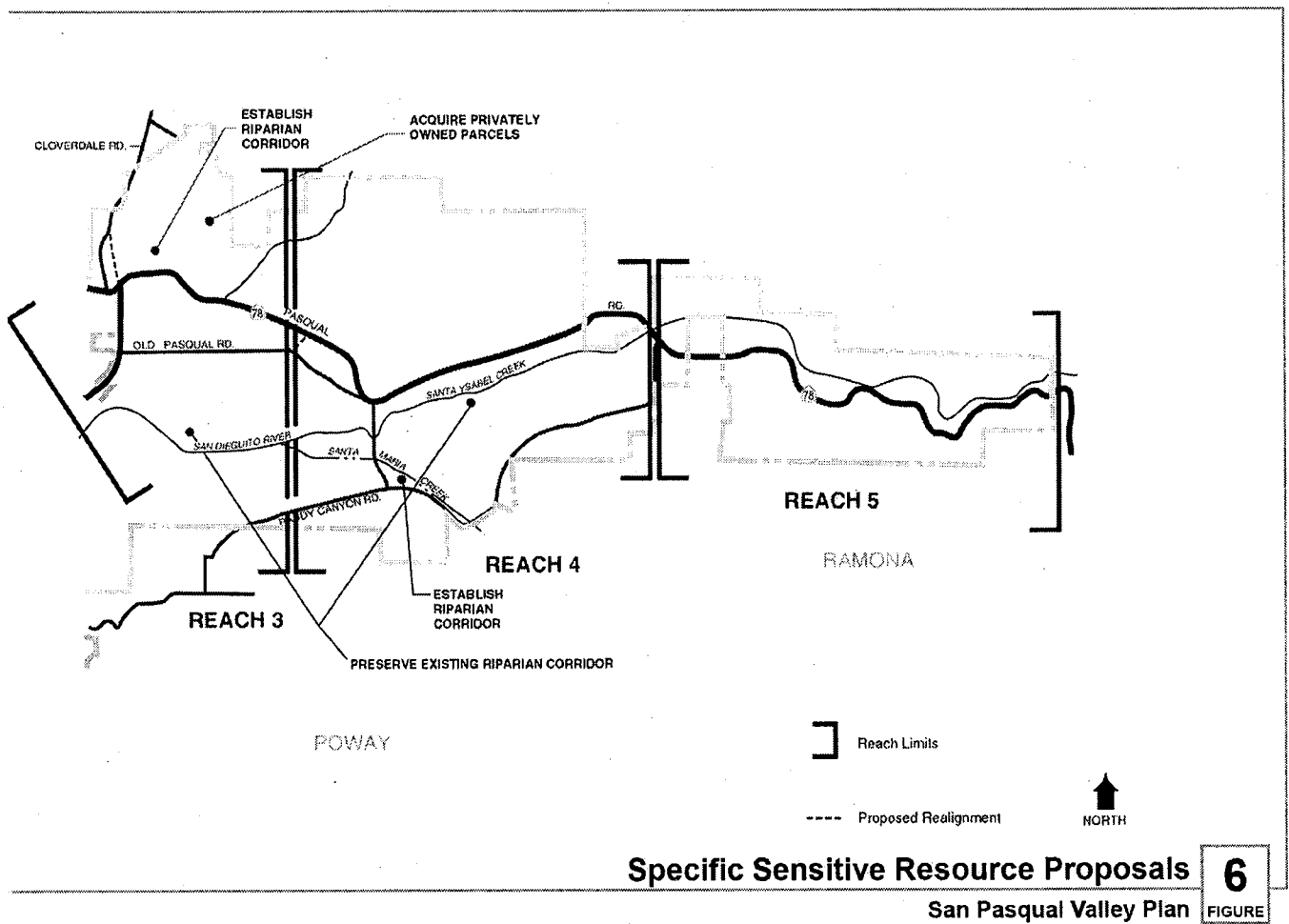
At present, widening the channel is infeasible, due to the cost of relocating the improvements on the Pinery Tree Farm lease. However, if the agricultural operation should change, or the tenant is willing to participate with the City, the land area necessary for establishing a channel bank with a shallower slope ratio and flood protection should be withheld from long-term use.

10. Preserve as open space the San Dieguito River floodplain between Hodges Reservoir and “the narrows” for future use as a “cornerstone” area for the MSCP preserve system. Riparian vegetation should be protected by removing livestock grazing and other agricultural uses from the floodplain. The existing cattle-grazing, soil-mixing and composting leases should be relocated elsewhere.

The Pinery nursery maintains a grove of pine trees adjacent to Highland Valley Road for use as seed stock. Maintenance of mature trees is compatible with the use of this area as open space.

11. Protect the coastal sage scrub habitat on the 26 acres that the state leases for the Mule Hill historical landmark. Mule Hill should continue to be maintained as open space. However, park uses for historical interpretation and visitor enjoyment may also be proposed. Low-impact park uses such as a trail, viewing area and historical marker would be consistent with maintaining the site as a visual and habitat resource.
12. The 100-acre squash farming lease on the north side of the floodplain should be considered for phased restoration of coastal sage scrub habitat to establish a wildlife connection between the riparian habitat and habitat preserved as open space in Escondido. The location, amount and timing of restoration will be evaluated. However, acquisition of privately-owned coastal sage scrub habitat elsewhere in the valley should be a higher priority for use of environmental mitigation funds; therefore, interim use of this area for sustainable agriculture should be permitted.





13. Designate the undisturbed habitat located on the steep slopes south of “the narrows” as open space. This area includes several parcels that are in private ownership. Acquisition of these privately-owned parcels using mitigation or open space funds should be a priority. If these parcels are not acquired, estate-density residential development pursuant to the A1-10 Zone, or its equivalent, shall be permitted. Development shall be limited to the least sensitive portions of these parcels with the more sensitive areas preserved as open space; and comply with resource protection regulations.

Reach 3

14. Preserve the existing approximately 800-foot-wide undisturbed riparian corridor along the San Dieguito River as a wildlife connection between the floodplain east of Hodges Reservoir (MSCP cornerstone land) and areas with upland habitat.
15. Establish a 300-500-foot-wide riparian corridor for use as a wildlife connection to upland habitat in Cloverdale Canyon. The following projects are needed to enhance the Cloverdale Creek riparian corridor:
 - Restore the riparian corridor to a 500-foot width through the Amsod lease. The creek channel will need to be widened to 500 feet to enable the riparian vegetation to establish.
 - Make enhancements to the riparian corridor as it passes through the Wild Animal Park lease between Old Pasqual Road and SR-78. Protect the riparian vegetation on the eastern edge of the corridor from further disturbance and remove the tamarisk and other exotic vegetation.
 - Restore a 300-foot riparian corridor through the De Jong Dairy lease. The corridor should be fenced to keep livestock from disturbing riparian vegetation, especially in the locations where livestock are permitted to cross the creek channel.
16. Designate the undisturbed habitat located on the steep slopes east of Cloverdale Canyon and north of SR-78 as open space. This area includes several parcels that are in private ownership. Acquisition of these privately-owned parcels using mitigation or open space funds should be a priority. If these parcels are not acquired, estate-density residential development pursuant to the A1-10 Zone, or its equivalent shall be permitted. Development shall be limited to the least sensitive portions of these parcels with the more sensitive areas preserved as open space; and comply with resource protection regulations.
- 16a. Preserve the steep slopes and sensitive habitat located on the Harwood and Mutual Assets properties north of the Wild Animal Park as open space. If these properties are annexed to the City of San Diego, estate density residential development may be permitted pursuant to the A1-10 Zone or its equivalent.

Reach 4

17. Protect the coastal sage scrub habitat on the 46 acres that the State leases for the San Pasqual Battlefield historical landmark. The San Pasqual Battlefield should continue to be maintained for historical interpretation and open space. Any expansion of park facilities should be limited to areas with the least impact to visual quality and sensitive biology.
18. Preserve the existing riparian corridor along Santa Ysabel Creek for use as a wildlife connection to upland habitat to the east.
19. Establish a riparian corridor along the Santa Maria Creek channel for use as wildlife connection to upland habitat to the south. Remove the creek channel from the dairy lease and install fencing to prevent livestock grazing in the creek channel while the riparian vegetation regenerates.
20. Preserve the undisturbed upland habitat south of Bandy Canyon Road as open space. Restore coastal sage scrub habitat where needed to strengthen the wildlife connection along Santa Maria Creek.

Reach 5

21. Preserve the existing riparian corridor along Santa Ysabel Creek for use as a wildlife connection to Pamo Valley.

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Revise leases		•		Real Estate Assets Department	General Fund	Proposals 1, 2, 5, 8, 9, 10, 11, 14, 16, 17, 19
Create MSCP "Cornerstone" preserve			•	Undetermined	Mitigation Funds	Proposals 7, 10
Restore riparian habitat			•	Undetermined	Mitigation Funds	Proposals 8, 14, 19
Restore coastal sage habitat			•	Undetermined	Mitigation Funds	Proposals 11, 18
Acquire privately-owned parcels			•	Undetermined	Mitigation Funds	Proposals 12, 15

MINERAL RESOURCES

BACKGROUND

The California Division of Mines and Geology has identified the San Pasqual Valley as being the second largest source of construction-grade sand in western San Diego County. The area designated by the State Mining and Geology Board as containing regionally significant construction aggregates is illustrated on **Figure 7**. The alluvial deposit is chiefly sand with layers of coarse material toward the upper end of the valley. The most easterly parts of the valley, having more coarse sand, are estimated to have approximately 95 percent Portland cement concrete sand. The material specifications for Portland cement concrete aggregate are more restrictive than for other aggregate types; therefore, fewer sand and gravel deposits in the county satisfy these specifications. The average thickness of the minable material throughout the valley is about 85 feet. However, the quality of the sand deposit from Hodges Reservoir east to “the narrows” is compromised by silt. The total resource in the valley has been estimated to be 510 million tons, all of which is Portland cement concrete grade sand.

Current sand removal operations in the valley are confined to the removal of sand within the San Dieguito River and its tributaries for flood control purposes, and to sand removal in conjunction with the maintenance of an irrigation pond adjacent to the San Dieguito River.

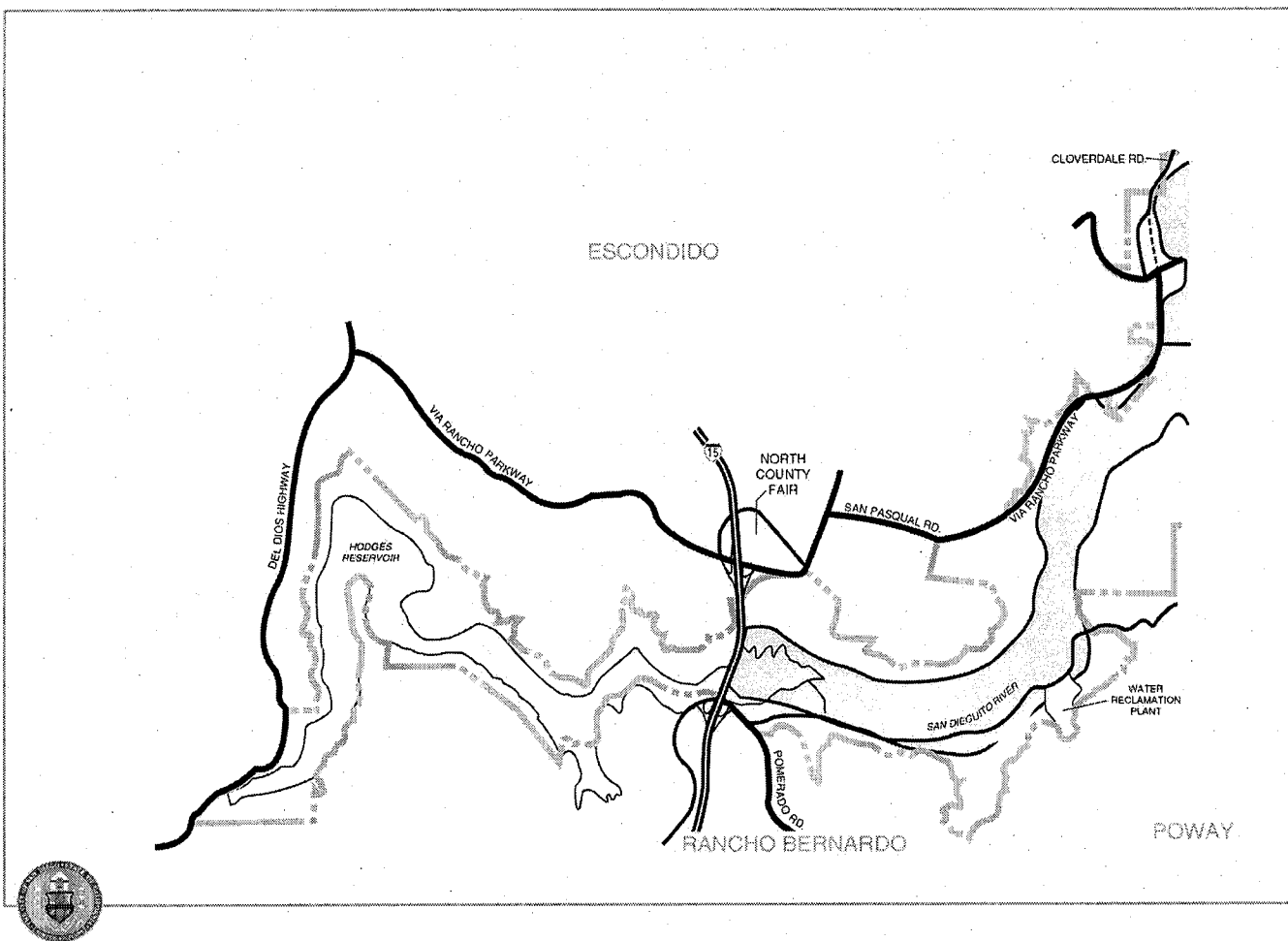
There are a number of objectionable characteristics that typically accompany more extensive extraction, processing and transportation of sand and gravel products. These include noise, vibration, air pollution, dust, impacts to hydrology and water quality, and the unattractive appearance of the site. Sand mining can cause permanent alteration to the floodway, creek channel and related biological resources, and these impacts conflict with the goal of this Plan to preserve a riparian corridor along the San Dieguito River and its tributaries. Also, sand mining has the potential to destroy cultural resource sites, both above and below the surface.

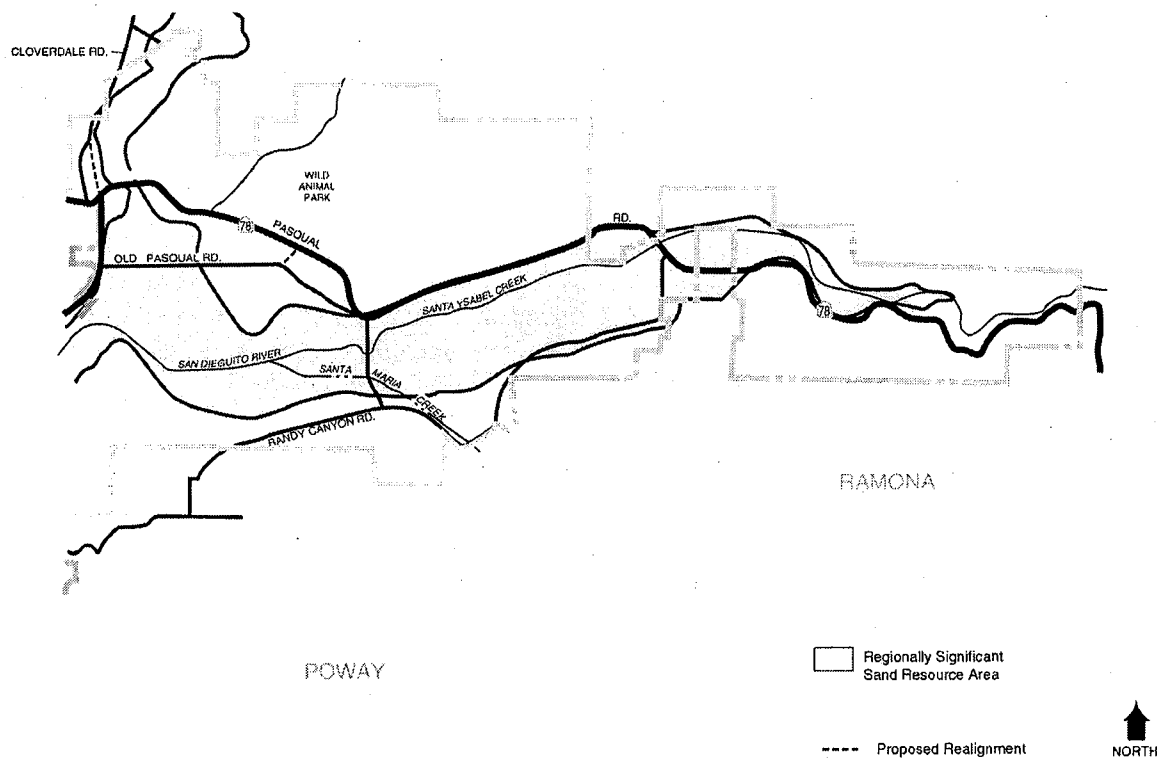
GOAL

- Preserved sand resources

POLICIES

1. Sand resources should be preserved. Any future consideration of this resource should only occur at the direction of the City Council.
2. Sand extraction activities should be limited to the removal of sand within the San Dieguito River and its tributaries for flood control purposes and maintenance activities only.





Mineral Resources
San Pasqual Valley Plan

7
FIGURE

FLOOD CONTROL

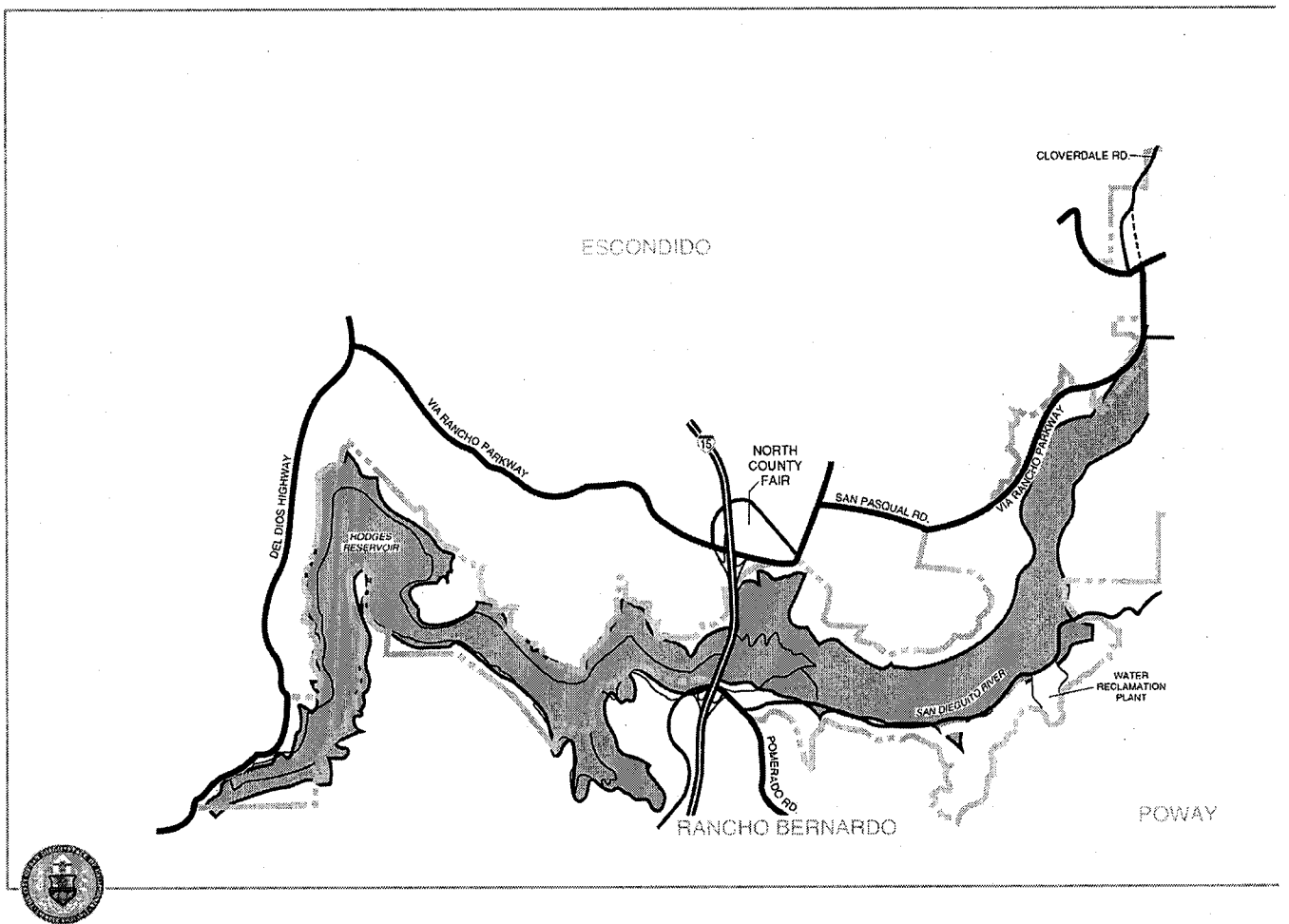
BACKGROUND

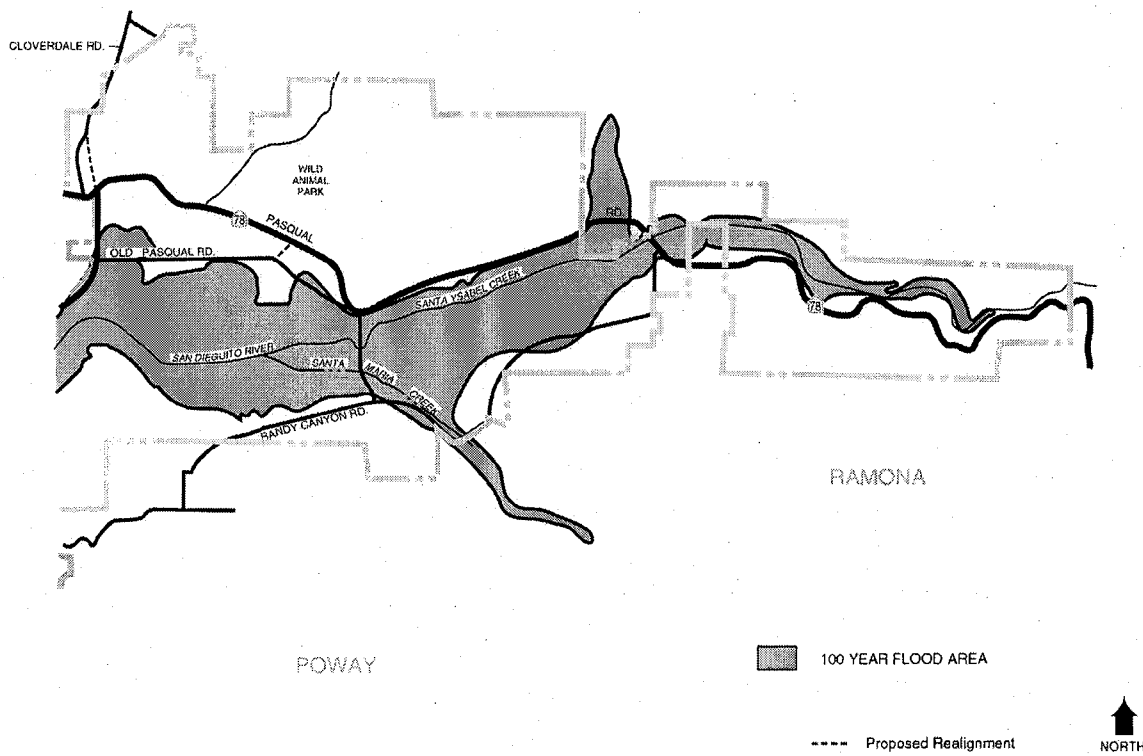
The San Pasqual Valley has a combined watershed of 350 square miles. Between 1947 and 1978, low annual rainfall resulted in very low flows in the San Dieguito River. In this period, flows exceeded the "five-year storm" peak flow only five times, and at no time was the "ten-year storm" peak exceeded. As a consequence, the natural watercourses of the creeks became very narrow and farming in the adjacent floodplain occurred at the very edge of these low-flow water courses.

The farmers who leased agricultural land from the City had been required, as a condition of the lease, to maintain the creek channels by removing sand for flood control purposes. However, as year after year passed with little or no flow in the creeks, flood control maintenance became sporadic and haphazard, deteriorating to mining pockets of high-quality sand rather than overall channel maintenance.

In 1978 and 1979, the ten-year storm peak flow was approached or exceeded. In 1980, a series of intense storms resulted in the equivalent of a 50/100-year flood which inundated several hundred acres of farmland (See **Figure 8**). After the floods of 1979-80 in San Pasqual Valley, excavation by lessees of City-owned property within the pilot channels of the San Dieguito River and its tributaries for flood control purposes was controlled by the Engineering and Development Department through Land Development Permits. The location, width and depth of excavation in both creeks were delineated on approved engineering drawings and periodic inspections were made to ensure compliance by the lessees. Excavation work resulted in a unified flood channel connecting various leaseholds in the Valley which significantly reduced the threat of flooding from a ten-year storm and damage to agricultural land. At the same time, the City shared in the income derived from the sale of excavated sand to the construction industry. Flood control measures have been implemented, however, without a complete analysis of the costs and benefits associated with these activities.

This Plan proposes flood control measures consistent with the goal of preserving a riparian corridor along the San Dieguito River and its tributaries and ensuring sufficient flood protection to allow for continued agriculture within the valley. Flood control measures are limited to the maintenance of a pilot channel within this corridor which utilizes the existing alignments, grades and cross sections with only minor modifications to improve the hydraulics of the streambeds without extensive excavation of sand and other environmentally sound flood control options, but only using a cost-benefit analysis. The City's current Streambed Alteration Agreement with the California Department of Fish and Game allows the removal of willows, weeds and other vegetation from the flood control channels within the San Pasqual Valley. The terms and conditions of that agreement limit the width of channel bottom maintenance to 40 feet, but do not permit the removal of sediment. It is unknown whether a hydraulic basis exists for the current dimensions of the permitted flood control pilot channel.





100-Year Flood Area
San Pasqual Valley Plan

8
FIGURE

GOALS

- Flood control measures limited to the maintenance by the City of the pilot channel within the riparian corridors of the San Dieguito River and its tributary creeks
- Flood control measures beyond maintenance by the City of the pilot channel within the San Dieguito River and tributary areas should be performed according to a cost-benefit analysis¹

POLICIES

1. All proposed flood control and bank stabilization measures shall be reviewed by the appropriate agencies for permit requirements.
2. All flood control measures shall be conducted in the context of multi-disciplined riparian corridor management that integrates flood control, erosion control, groundwater recharge, ecosystem protection, resource protection and provision for recreation.
3. All flood control measures shall be based upon identified risk assessments from hydraulic modeling and shall be conducted according to the least environmentally damaging methods.
4. A cost-benefit analysis¹ shall be conducted to determine the feasibility of all flood control measures.
5. All channel maintenance shall, at the City's option, be performed by the City and shall generally be limited to cutting, mowing and disking of vegetation within the approximately 40-foot-wide existing pilot channel bottom to maintain flood carrying capacity. This maintenance may include the removal of sand. Existing leases that allow for maintenance of certain channel configurations shall be honored by the City, unless and until such leases are modified.
6. Periodic sand removal in the riparian open space corridor beyond maintenance of the 40-foot pilot channel can be considered only if determined to be beneficial to the riparian corridor as part of the implementation of an approved restoration plan.

1. As necessary, refer to specialized literature on the methods of estimating cost and benefits. The cost-benefit analysis should consist of a study of the costs associated with specific flood control proposals and in particular locations in the valley, measured against their benefits. The benefits will consist primarily of the economic benefit to leaseholders derived by having agricultural fields and orchards protected from periodic flooding. The value of the crops being protected can be calculated. Calculation of flood control costs should include contraction costs (materials and labor); ongoing maintenance; and assessment of environmental impacts (hydrological, sensitive resources, and so on); and permitting requirements. The cost and benefits of particular flood control proposals must also be evaluated over time, since flooding in the valley is periodic and major floods occur infrequently. With a clearer understanding of the benefit and cost, a more objective decision can be made whether to proceed.

SPECIFIC PROPOSALS

1. Modify existing leases to allow pilot channel maintenance by the City not the lessees.
2. Maintain an approximately 40-foot-wide pilot channel bottom to maintain flood carrying capacity.
3. Study economically and environmentally sound approaches to providing the minimum flood control to support agriculture within the San Pasqual Valley.

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Modify leases to allow pilot channel maintenance by the City		•		Real Estate Assets Department	N/A	Proposal 1
Maintain 40-foot-wide pilot channel		•		Water Utilities Department	Water Utilities Department	Proposal 2
Study economically and environmentally sound approaches to providing the minimum necessary flood control		•		Leaseholders, Water Utilities Department	Undetermined	Proposal 3

PARK AND RECREATION

BACKGROUND

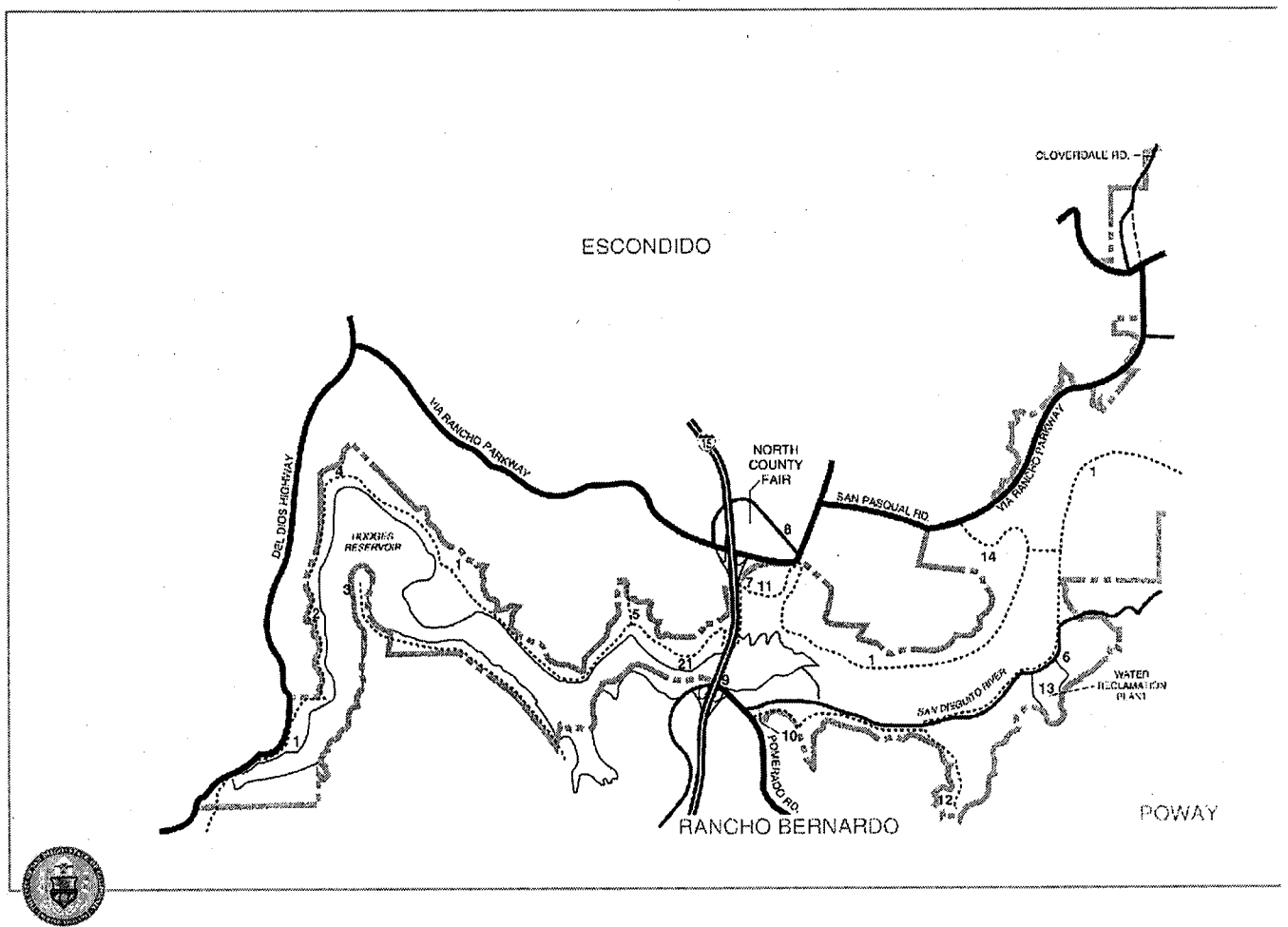
Consistent with the adopted community plan, the valley is generally free from development. This open space character results from a number of factors, including extensive agricultural operations, Hodges Reservoir, the Wild Animal Park and two large areas reserved for historical parks. The planning area also represents a portion of a larger open space system proposed by the General Plan extending from the Pacific Ocean to the easterly City limits.

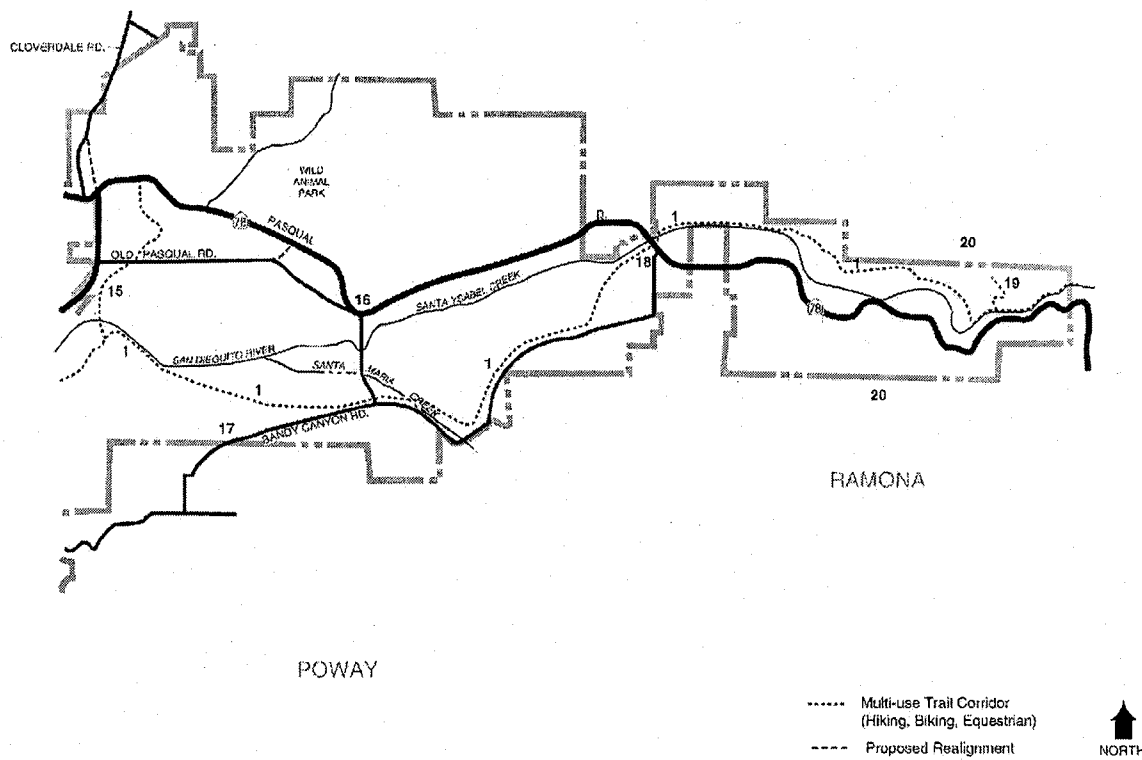
Since its construction (1917-1918), Hodges Reservoir has served as a significant regional recreation resource available to San Diego County residents as well as visitors to the region. Recreational activities on Hodges Reservoir are managed and operated through the Water Utilities Department's City Lakes Program. The City Lakes Program is comprised of the City's ten municipal water supply reservoirs. While the primary purpose of the City Lakes has been to serve as reservoirs to provide drinking water to city residents, limited recreational uses have been allowed at the reservoirs provided the uses did not interfere with the quality and production of water. The City Lakes Committee, comprised of citizens of the Park and Recreation Board, serves in an advisory capacity regarding programs, activities and policies to the Water Utilities Department and City Council.

In order of popularity, water activities today on Hodges Reservoir include fishing, boating (powerboats, canoeing, kayaking and sailing) and boardsailing. The nutrient-rich water has resulted in an outstanding naturally reproducing warm-water fishery. In addition to its popularity among county anglers, the reservoir also draws significant numbers of visitors from Orange, Riverside and San Bernardino counties. Shoreline activities including picnicking, hiking/walking and bicycling.

The San Pasqual Valley is an agricultural preserve and does not have a large population. While the small population in the valley does not warrant provision of neighborhood or community parks, the San Dieguito River Regional Park Concept Plan proposes the development of a regional trail system through the San Pasqual Valley. The Concept Plan also envisions the future establishment of other complementary recreational facilities within the San Pasqual Valley such as trail staging areas, a pedestrian/bicycle bridge across Hodges Reservoir and a camping facility. The recommendations contained within the Concept Plan and San Dieguito River Regional Plan have been used as the basis for the proposals contained in this Plan.

The San Dieguito River Valley Regional Open Space Park Joint Powers Authority (JPA) was formed in 1989 by its member agencies, including the City of San Diego, to preserve and restore land within the San Dieguito River Valley as a regional open space greenway and park system, with a continuous and coordinated system of preserved lands and a connecting corridor of walking, equestrian, and bicycle trails. The proposed trail corridor, referred to as the "Coast to Crest Trail" would extend from the ocean between Del Mar and Solana Beach to Volcan Mountain, north of Julian. The trail corridor is proposed to extend through the San





Proposed Park and Recreation Land Use
San Pasqual Valley Plan

9

FIGURE

Pasqual Valley planning area in an east/west orientation. Portions of this trail system which have already been completed include the Mule Hill and San Pasqual Valley segments of the Coast to Crest Trail, the Piedras Pintadas Trail at Bernardo Bay, the trail along Highland Valley Road and 14 miles of trail located on the Bureau of Land Management land in Clevenger Canyon.

GOALS

- A continuous multiuse trail corridor for walking, equestrian and bicycle use extending east/west through the valley
- Secondary trail corridor linkages to major open space areas outside the valley
- Compatible recreation facilities that do not compromise the valley's natural character or agricultural uses
- Find an appropriate location for and establish an interpretive center in the valley that will promote the River Park and the history of the San Pasqual Valley.

POLICIES

1. The park shall be designed as a natural, open space park that interprets the significance of the valley's diverse natural and man-made resources.
2. Recreation uses shall have a low impact on the valley's natural resources and on adjacent land uses, including agriculture.
3. Recreation uses shall be designed to serve regional open space recreational needs and according to the Design and Development Standards contained in Appendix E.
4. The multiuse trail corridor, forming the San Pasqual Valley segment of the JPA's "Coast to Crest Trail," shall be aligned to minimize impacts to sensitive resource areas and to agriculture.
5. The proposed bikeway system should be designed to serve regional recreational and transportation needs and to connect with adjacent bikeway systems.
6. Trail corridors shall be included in all public-land leases and lease renewals.
7. The San Dieguito River Park has been given the authority through the Joint Powers Agreement (JPA) to undertake overall planning for and to plan, design, improve, operate, manage and maintain the San Dieguito River Park. Therefore, the proposed trail corridor and related recreational facilities within the valley shall be designed and implemented through the joint efforts of the City of San Diego, as the land owner, and the JPA.
8. Recreational use of Hodges Reservoir shall be developed in a manner consistent with the reservoir's use as a source of public water supply.

SPECIFIC PROPOSALS

Proposed park and recreation facilities are shown on **Figure 9** and are described below. Although the location of a camping facility and an old-fashioned family farm has not been determined, these uses may be desirable in the future. **Figure 9** illustrates the trail corridor location rather than a specific alignment. In order to determine the feasibility and specific alignments of the trail corridor within the planning area, additional site-specific design work and property owner/leasehold coordination must be completed.

1. Implementation of the "Coast to Crest Trail," a continuous 24-foot-wide multiuse trail corridor for walking, equestrian and bicycle use extending east/west through the valley:
 - a. The recommended standards for a multiuse trail corridor are provided in the following chart. These standards are guidelines, and the trails may vary from the standards where necessary.
 - b. To the extent possible, the entire hard-surfaced bicycle path will meet the requirements of the California Department of Transportation for Class I bicycle paths.
 - c. The trail corridor alignment will follow the seam between land uses and follow (or be adjacent to) existing dirt fire roads and farm roads to minimize impacts to agriculture and to the natural environment.
 - d. Trail fences should be installed when security and/or protection of sensitive resources or farmlands is required.
 - e. A 24-foot-wide multiuse trail corridor may be infeasible due to steep topography east of the SR-78 bridge and the presence of sensitive riparian habitat along Highland Valley Road. In these instances it may be advantageous to provide separate Class I or Class II bicycle facilities in conjunction with road improvements.
 - f. No motorized vehicles will be permitted on trails with the exception of maintenance and police vehicles.
2. Parking/access/picnic area.
3. Hiking trail to Fletcher Point. This is an existing utility road which is currently used by hikers and bicyclists.
4. Existing staging area for hikers and bicyclists.
5. Secondary trail connection to Felicita Park in Escondido.
6. Trail connection from the Heritage development in Poway to the San Pasqual Valley Trail to connect trails in Poway to the Coast to Crest Trail.
7. Restored Sykes Adobe historical site. The Adobe is envisioned to become a valuable interpretive resource for surrounding communities.
8. Secondary trail connection to Kit Carson Park in Escondido.

TABLE 1
RECOMMENDED MULTIUSE TRAIL STANDARDS

Tread Width	8-foot bicycle access trail with a 4-foot center, along side a 4-foot hiking/equestrian trail
Right-of-Way Width	24 feet
Clearance Width	20 feet
Vertical Width	12 feet
Cross Slope	2%
Design Grade	0-5%
Maximum Grade	10%
Recommended Surface	Stabilized soil, concrete, or asphalt for bicycle/whole access trail, native or imported* soil for hiking/equestrian trail
Recommended Barrier	Center should be a hedge or split-rail fence. Trail fences should be installed when security and/or protection of sensitive resources or farmlands is required.

* Imported soil, such as decomposed granite, should complement the native soil color.

9. Secondary trail connection for walking and bicycling to proposed trail system and interpretive center in the Bernardo Bay area of Rancho Bernardo.
10. Existing staging area possibly enlarged for horseback riders. Includes access to the existing Highland Valley Trail. This facility should be adequately landscaped to minimize visual impacts.
11. Equestrian staging area.
12. Secondary trail connection through Sycamore Canyon to open space preserves in Poway.
13. Interpretive area for San Pasqual aquatic treatment plant.
14. Secondary trail corridor connection to the winery.
15. Secondary trail connection to Cloverdale Canyon.
16. Secondary trail connection to San Pasqual Battlefield State Historic Park.
17. Scenic overlook along the north side of Bandy Canyon Road.
18. Staging area for hikers, bicyclists and equestrians.
19. Secondary trail connections (East San Pasqual Trails) to the 2,018 acres acquired from the U.S. Bureau of Land Management with ultimate connections north to Boden Canyon and eastward toward the Pamo Valley.
20. Annex to the City of San Diego, and designate as open space, the 2,018 acres acquired from the U.S. Bureau of Land Management in order to assure preservation of this land (see **Appendix D**).
21. A pedestrian/bicycle bridge across the Hodges Reservoir.

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Design and construct multiuse trail corridor and related park facilities			•	San Dieguito Joint Powers Authority (JPA)	Bonds, Transnet Bikeway Funds, other unidentified	Proposals 1-19
Annex BLM land			•	Planning Department, City Council	Water Utilities Department	Proposal 20

CULTURAL RESOURCES

The San Dieguito River Valley Planning Area contains a wealth of prehistoric, historic and Native American resources. These include hundreds of archaeological sites, four designated historic sites and numerous sites and structures with historic value, potentially eligible for historic designation.

The earliest archaeological evidence of Native Americans in the San Diego area is the San Dieguito complex, dating from approximately 8,000 to 11,000 years ago. The culture represented by the San Dieguito group appears to be a hunting-oriented society. Two other prehistoric cultures followed, the La Jolla complex (7,000 years ago) and the Cuyamaca complex (1,500 years ago until the time of the Spanish contact in 1769). Both represented hunting and gathering cultures.

The San Pasqual Valley contains resources from the three major "post-contact" historical periods in California: the Spanish, that began with the founding of Mission San Diego in 1769; the Mexican, that began with the secularization of the mission and the founding of the pueblo of San Pasqual in 1835; and the American, that began with California statehood in 1849.

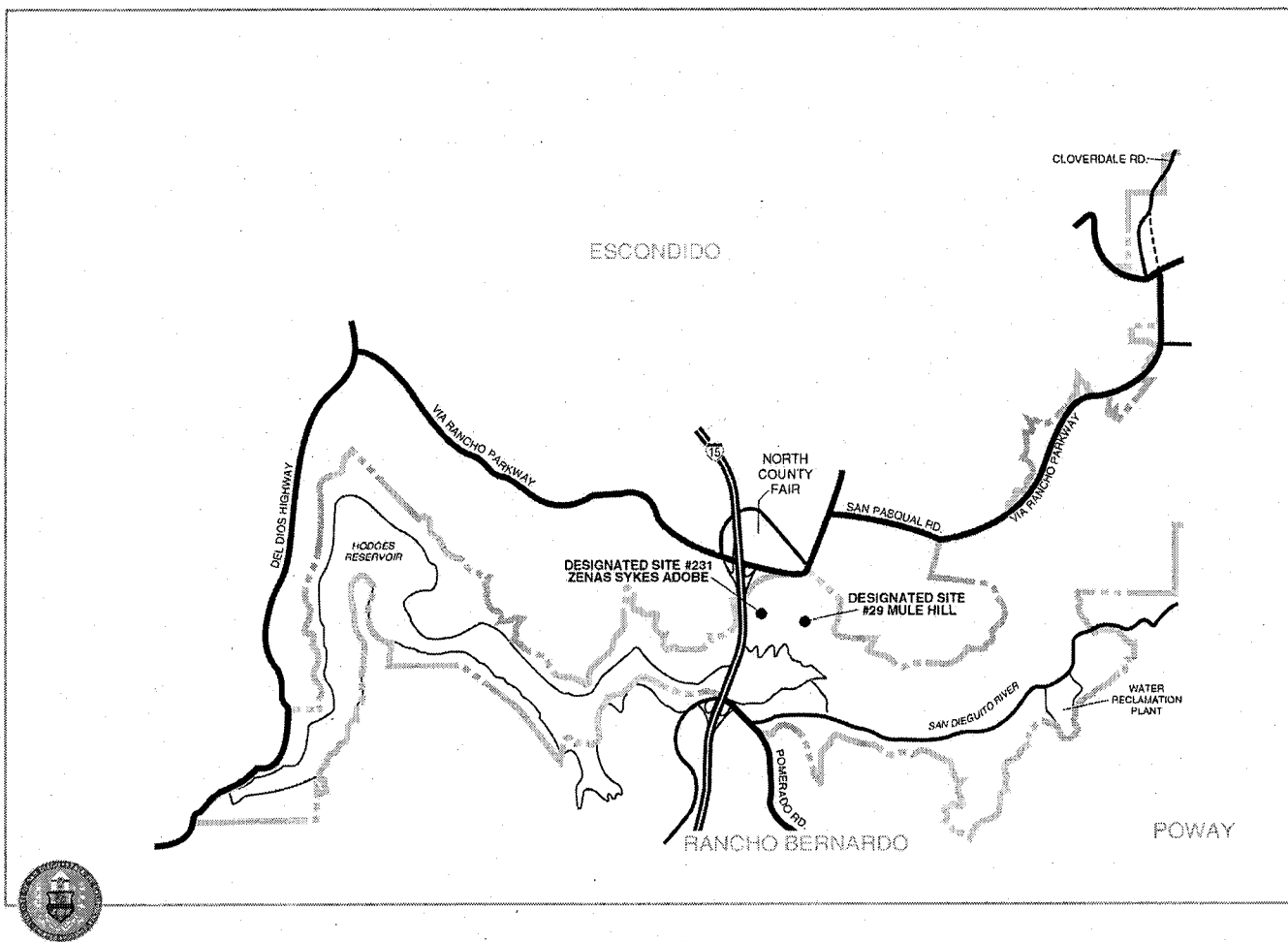
The Mission San Diego de Alcalá and the Presidio of San Diego were founded in 1769, bringing about profound changes in the lives of the valley's native population, and the ultimate destruction of their economy. The San Pasqual Valley was the home of a significant Native American population.

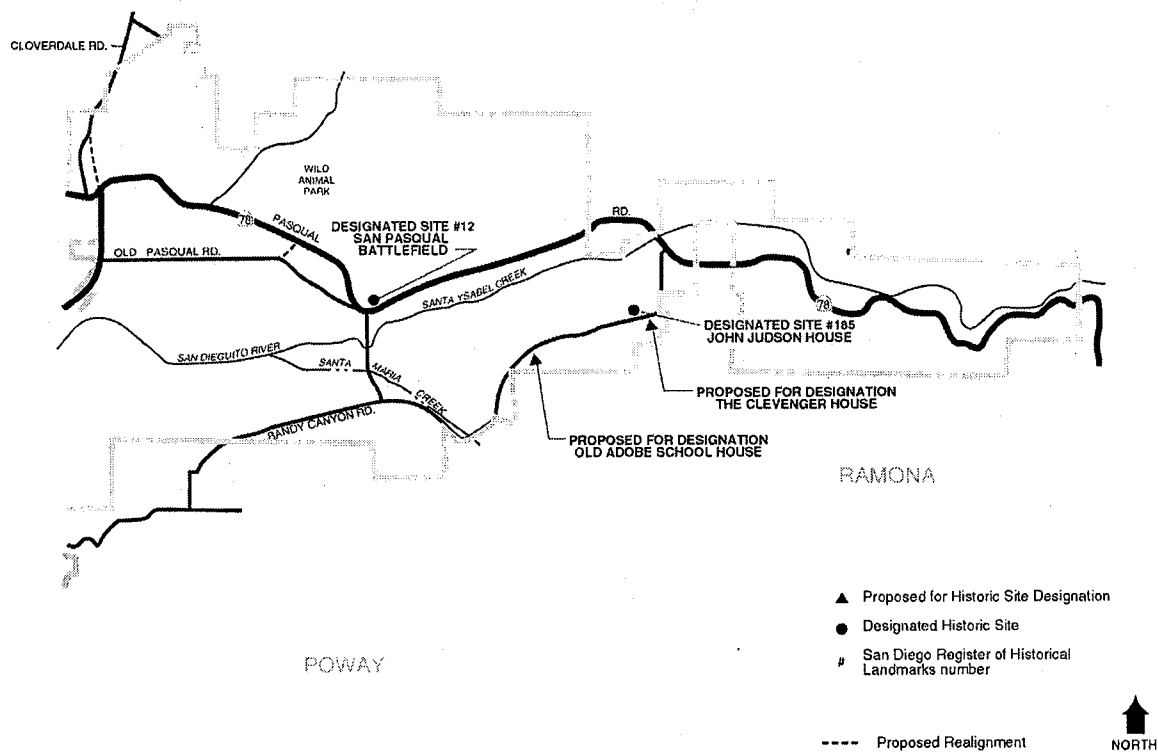
Following Mexico's independence from Spain in 1821, the missions were secularized by the new government. In response, the padres established several communities to house new converts. One of these was in the San Pasqual Valley, the Pueblo of San Pasqual.

As settlers began to move into the valley in the 1850s and 1860s, sentiment grew for the creation of an Indian reservation. In 1870 the San Pasqual Valley and adjacent parts of Pamo Valley, Santa Maria Valley and Highland Valley were set aside as a reservation. Due to protest from the settlers, the reservation was closed 15 months later. Another reservation was not established until 1910, in the Valley Center area.

Once the San Pasqual reservation was revoked, settlement of the valley greatly increased. Early settlers were farmers and ranchers who cultivated the floodplain and used the waters from Santa Ysabel Creek for irrigation. This historic rural period continued up through the 1930s. However, the community retains a distinctly rural character even today due to the City's ownership and maintenance of the valley as an agricultural preserve.

The known prehistoric archeological sites consist primarily of small, limited activity sites and temporary camps. The small limited activity sites include bedrock milling sites where vegetal material was being ground and quarry sites where raw stone materials were collected or made into tools. Temporary camps were small habitation sites occupied for short periods of time.





Cultural Resources **10**
San Pasqual Valley Plan **FIGURE**

While many of these sites may not appear to be important individually based on low artifact density and heavy disturbance by agricultural activities, they are significant as a larger district. This group of sites presents an opportunity to study a whole community in the prehistoric and post-contact periods. There is also a potential for buried sites in the planning area because continual flooding and plowing repeatedly covers and uncovers material. Most importantly, these sites are significant for their heritage value to the Native American community.

Additionally, the cultural heritage of the valley is also linked to agriculture. The rich diversity of farming in the valley is in itself a reminder of agricultural traditions. The historic sites in the valley include foundations and standing structures that are related to the historic agricultural community of San Pasqual. In addition, trash deposits and privies in the valley have the potential to provide information on the lives of the residents of the valley and how rural life differed from town life.

Many of the structures are in relatively good condition and preserve the dominant architectural style of the community. In addition, a number of agricultural features including irrigation systems, barns and silos are to be found in the planning area. The San Pasqual Valley is one of the last areas of its size to preserve such a good selection of the houses and outbuildings of rural San Diego County.

The following four sites are listed in the San Diego Historical Landmarks Register: the San Pasqual Battlefield, Mule Hill, the John B. Judson House and the Zenas Sykes Adobe (See **Figure 10**).

The General Plan recommends the preservation of San Diego's rich historical and prehistoric tradition so that it may become part of the consciousness of the present and future generations.

GOALS

- Preserve and protect archaeological sites throughout the planning area, including the traditional cultural resources of the Native American community
- Preserve and protect historic resources in number and type so as to accurately represent the distinctive character of each era of the San Pasqual Valley's history, including the traditional cultural resources of the Native American community
- A comprehensive cultural resources data base for the entire planning area

POLICIES

1. Protect and maintain significant cultural resources as determined by a comprehensive cultural resource survey.
2. Protect and maintain the historic agricultural character of the San Pasqual Valley.

SPECIFIC PROPOSALS

1. Complete a cultural resources survey and evaluation program for the entire planning area. Fill in survey gaps (those areas that have not been previously surveyed or surveyed five or more years earlier). Resurveying is important due to the development of more sophisticated survey techniques, and in the case of San Pasqual, due to the constantly changing alluvial and farmed ground surface.
2. Significant cultural resources are protected under the Resource Protection Ordinance (RPO). Therefore, prior to completion of a comprehensive cultural resource survey for the valley, new or renewed leases shall contain a provision requiring a cultural resources survey. If archaeological sites are discovered, mitigation measures shall be developed on a case-by-case basis. Appropriate mitigation may include, but not be limited to, the following:
 - a. Avoidance of the site through excluding the resource area (including a buffer area) from the leasehold. This measure includes a requirement to determine probable site boundaries.
 - b. If avoidance is not feasible, site shall be evaluated to determine their importance, using the criteria contained in Appendix K of the California Environmental Quality Act. In addition, discovered resources shall be evaluated for importance according to RPO. If a site is found to be significant, a data recovery program which is based on a research design shall be implemented.
 - c. If a site is determined not to be important, no further cultural resources work shall be necessary and avoidance of the site shall not be required.
 - d. All surveys, evaluations, research, design and data recovery efforts shall be performed by a qualified archaeologist using recognized professional methods. A qualified archaeologist is defined as an individual who is certified by the Society of Professional Archaeologists (SOPA). At least 200 hours of the field experience required for certification must have been obtained in Southern California.
3. On parcels where no surface cultural components are found through the survey, lease conditions may include a reasonable limitation on the depth of plowing. This condition shall be determined on a case-by-case basis.
4. New or renewed leases shall require the retention of structures and/or features on-site whenever possible. Removal of historic resources from original or long-established sites destroys their historical context.
5. The Historic Site Board should consider for historic site designation, the old adobe schoolhouse and the Clevenger house (see **Figure 10**).

6. Identify San Pasqual as a rural historic landscape and evaluate its National Register eligibility. An historic landscape is a geographic area that historically has been used by people, or shaped or modified by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage, or continuity of areas of land use, vegetation, buildings and structures, roads and waterways, and natural features.
7. Explore and apply for federal, state and local funding sources for the acquisition, preservation and management of cultural resources.
8. Old Adobe Schoolhouse to be restored and interpreted as part of a "Settlers Park."

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Complete cultural resource survey	•			Development Services Department	Water Utilities Department	Proposal 1
Require resource evaluation in new or renewed leases		•		Real Estate Assets Department	N/A	Proposal 2
Exclude archaeological resource areas from leaseholds		•		Development Services and Real Estate Assets Departments	N/A	Proposal 3
Require the retention of historic features on site in new or renewed leases		•		Real Estate Assets Department	N/A	Proposal 4
Pursue historic site/historic landscape designations	•			Planning Department, Historic Site Board	Water Utilities Department	Proposals 5, 6
Explore funding sources		•		Planning Department, Water Utilities Department, Historic Site Board, Joint Powers Authority, Parks and Recreation Department	N/A	Proposal 7

CIRCULATION

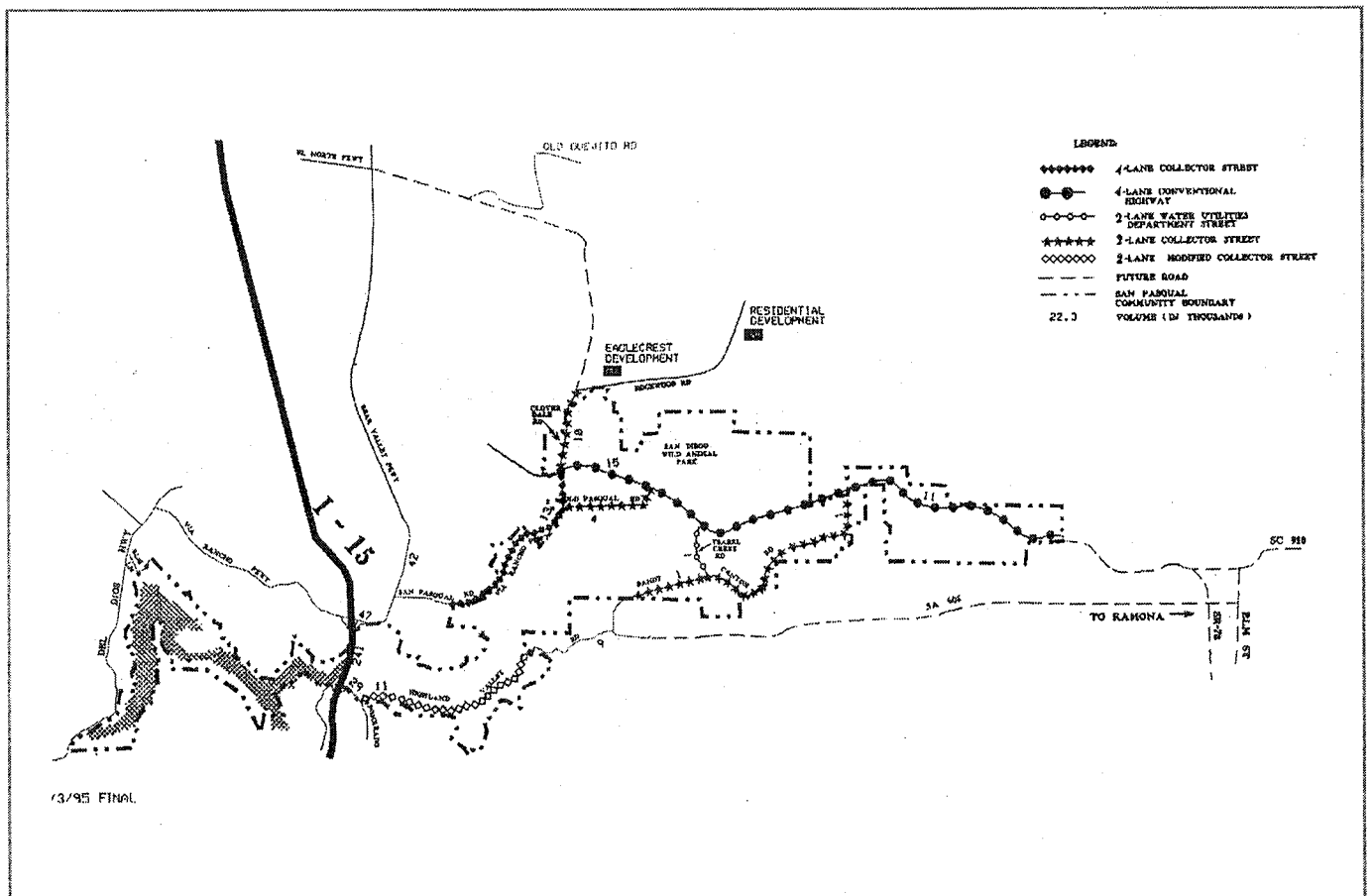
BACKGROUND

Due to the rural nature of the San Pasqual Valley, the area's existing circulation system is relatively limited. One of the functions of the circulation system in the valley is to accommodate regional traffic between Escondido and Ramona. SR-78 (San Pasqual Valley Road) provides the main access to the valley and extends from Escondido southeasterly into the San Pasqual Valley and follows the foot of the slopes along the north side of Santa Ysabel Creek. It then turns south up Clevenger Canyon toward Ramona. Interstate 15 bisects the planning area in a north-south direction providing access to the valley at interchanges with Via Rancho Parkway and Pomerado Road. San Pasqual Road (renamed Via Rancho Parkway through the City of San Diego) provides an extension eastward to SR-78. From I-15, Via Rancho Parkway in Escondido connects with the Del Dios Highway to the West, a county road that links Escondido with the coastal community of Del Mar. Access to Hodges Reservoir is from the Del Dios community, located on the western shore of the lake.

The San Pasqual area is served by the Route 307 bus line, which runs from Escondido to Ramona along SR-78, and by Route 308 which operates on the Del Dios Highway and links Escondido, Solana Beach, and the Cardiff Towne Center. In addition, the plan area is in the vicinity of the North County Fair Transit Center. San Diego Transit bus lines operating out of this center include Route 20 (Downtown San Diego Express) and Route 230 (Rancho Bernardo-Downtown San Diego Peak Hour Express). North County Transit District bus lines operating from this center include: Route 384 (Escondido), Route 382 (Ninth Avenue Juniper Street), and Route 320 (Oceanside-Carlsbad-Vista-San Marcos Express). The current Short Range Transit Plan, FY 1994-2001, published by the Metropolitan Transit Development Board (MTDB), does not list any future improvements to San Pasqual's existing transit service.

The long-term transit needs of the San Pasqual Valley are currently being evaluated as part of the Metropolitan Transit Development Board's (MTDB) M5 Advance Planning Study. The study area covers the I-15 corridor from Centre City San Diego to North County Fair. This study will compare a number of alternative types of transit improvements including alignments, stations and modes (both rail and express bus options). Feeder bus services will also be evaluated. Current plans to extend the I-15 High Occupancy Vehicle (HOV) lanes to SR-78 will be included in the analysis. Study recommendations are expected in mid-1996.

Three bikeway classifications are used throughout the City of San Diego. The three classifications are Class I (bike paths), Class II (bike lanes), and Class III (bike routes). Class I bicycle facilities (typically located in open space areas) consist of a completely separate right-of-way for the exclusive use of non-motorized vehicles and pedestrians. Class II facilities (typically located on major streets) consist of a restricted right-of-way on the paved road surface alongside the traffic lane nearest the curb. These facilities are identified by special signs, lane striping and pavement markings. Class III facilities (typically located on neighborhood streets) consist of a shared right-of-way designated by signs only. With Class III facilities, bicycle traffic shares the roadway with motor vehicles.



Horizon Year Average Daily Traffic (ADT) and Recommended Street Classifications
San Pasqual Valley Plan

11
FIGURE

The existing bikeway system in the San Pasqual Valley is limited to a bicycle route along the shoulders of 1-15 connecting the Class II bicycle lanes along Pomerado Road in Rancho Bernardo with Escondido. The Pomerado Road bike lane is part of the citywide commuter-oriented bikeway system. This system encourages bicycle usage for both leisure and work trips, thereby helping to relieve traffic congestion and improve regional air quality.

GOALS

- A vehicular circulation system that adequately accommodates the needs of residents and visitors to the valley as well as regional traffic.
- An efficient and environmentally sensitive transportation system that is compatible with the valley's rural character.
- A bicycle circulation system throughout the valley with connections to bikeways in adjacent communities.

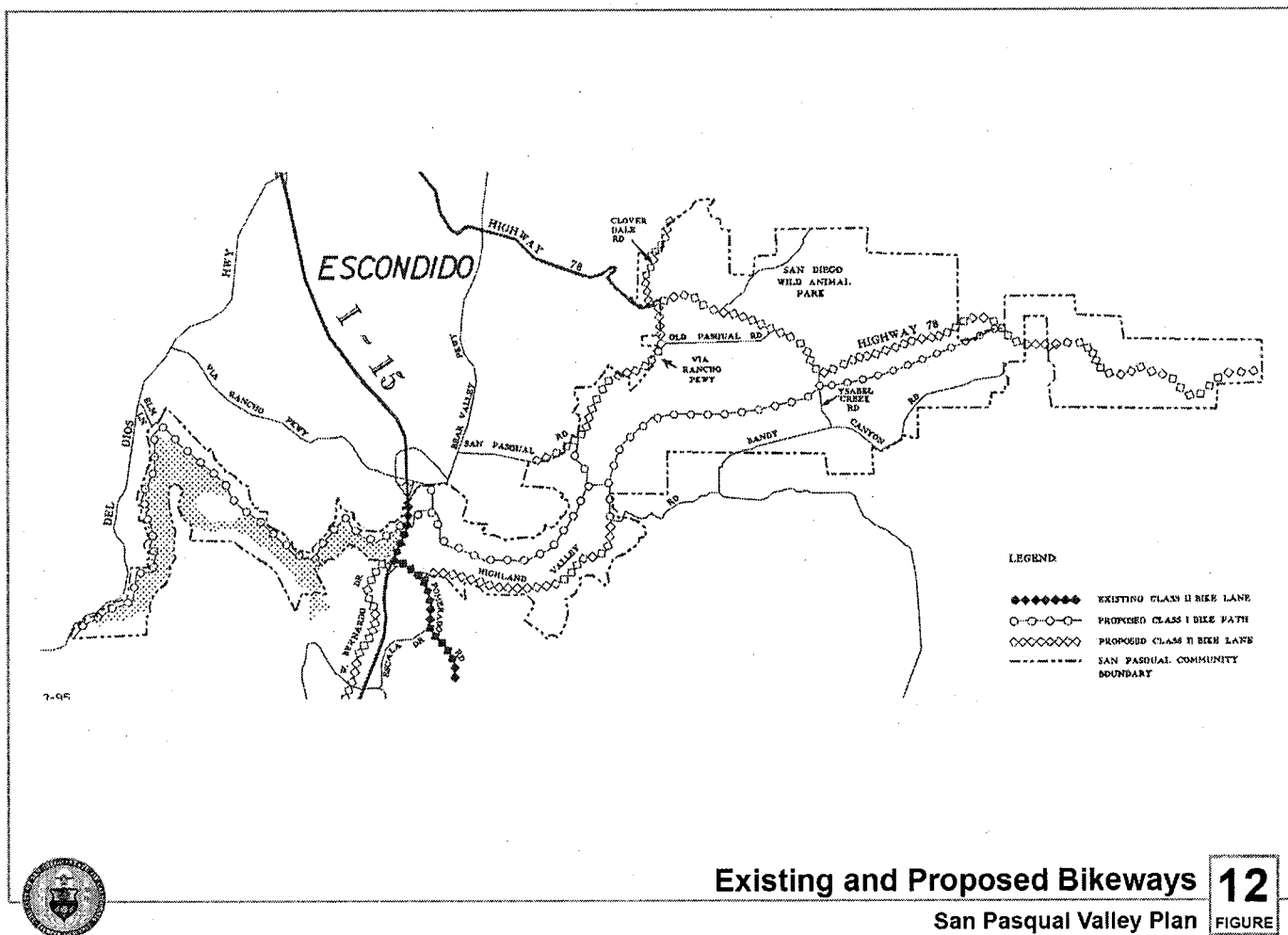
POLICIES

1. Transportation facilities shall be regarded as an integral part of the landscape in which they are sited.
2. Street improvements shall be compatible with the rural character of the valley. Consideration should be given to minimize impacts to the landform, where safety permits, and as determined by the City Engineer.
3. Street widths shall be the minimum necessary to provide safe travel and emergency parking.
4. The San Dieguito River Valley Park Concept Plan shall be used as a guide in designing the bicycle system.

SPECIFIC PROPOSALS

1. SA-603 is a county road planned as an alternate to SR-78 between Escondido and Ramona following a route south of the San Pasqual Valley. The proposed route for SA-603 would cross the valley beginning at the intersection of Via Rancho Parkway and Old Pasqual Road, continue south through "the narrows" and connect with Highland Valley Road in the county. SA-603 is designated as a major street in the Circulation Element of the General Plan.

This Plan proposes to delete the portion of SA-603 between Via Rancho Parkway and Highland Valley Road. Because the adopted alignment for the proposed SA-603 extension would pass through the floodway of the San Dieguito River and climb through a finger canyon on the steep south slope of the valley, construction of the roadway would require extensive grading and fill areas. Although a less environmentally sensitive alignment could be proposed, any new road would have a detrimental effect on the rural character of the valley.



Existing and Proposed Bikeways
San Pasqual Valley Plan

12
FIGURE

2. The recommended street network improvements are shown in **Figure 11** and described below. These improvements are necessary to adequately accommodate projected traffic.
 - a. Widen Highland Valley Road to a two-lane modified collector (55 mph design speed), with Class II bicycle lanes, from Pomerado Road to the easterly City limits.
 - b. Widen San Pasqual Valley Road SR-78 to a four-lane conventional highway with Class II bicycle lanes consistent with the Ultimate Transportation Corridor shown in the Route Concept Report for SR-78 prepared by Caltrans. According to this report, 148 feet of right-of-way is needed for this improvement.
 - c. Widen Via Rancho Parkway (San Pasqual Road) to a four-lane collector street with Class II bicycle lanes from the City boundary with Escondido to SR-78.
 - d. Realign Cloverdale Road to intersect with SR-78 and Via Rancho Parkway and retain Cloverdale Road as a two-lane collector street with Class II bicycle lanes in the City of San Diego connecting to Bear Valley Parkway in the City of Escondido.
 - e. Reconstruct flood-damaged Ysabel Creek Road between SR-78 and Bandy Canyon Road to a two-lane street in an environmentally sensitive manner. Maintain Ysabel Creek Road as a private street owned by the City of San Diego Water Utilities Department.
 - f. Realign the intersection of Old Pasqual Road with SR-78 to a more perpendicular alignment. A location approximately 3,500 feet west of the existing intersection is proposed.
 - g. Widen Pomerado Road at the 1-15 over-crossing to a four-lane major street with Class II bicycle lanes and signalize the westerly portion of the interchange as recommended by Caltrans. Also recommended is the addition of another left-turn lane to the northbound on-ramp by restriping one of the westbound through lanes on Pomerado Road.
 - h. Widen Bear Valley Parkway to six lanes northerly from the present six-lane section, through the intersection with San Pasqual Road. This roadway is within the city of Escondido.
3. Reconfigure key intersections in order to maintain acceptable levels of service as illustrated in **Table 2**.
4. Construct the bikeway system as shown on **Figure 12**. Bikeway standards are described on **Figure 13**.

TABLE 2
SAN PASQUAL EXISTING AND RECOMMENDED INTERSECTION CONFIGURATIONS***

Intersection	Existing	Proposed	Responsible Agency
Bandy Canyon Road/Highland Valley Road	Unsignalized SB: 1LR WB: 1TR EB: 1LT	Unsignalized Same as Existing	County of San Diego
Pomerado Road/I-15 northbound	Signalized WB: 1L, 1T NB: 1L, 1R EB: 2T, 1R	Signalized WB: 2L, 1T NB: 1L, 1R EB: 2T, 1R	Caltrans
Pomerado Road/I-15 southbound	Unsignalized WB: 1L, 1T NB: 1L, 1R EB: 1T, 1R	Signalized WB: 1L, 2T NB: 1L, 2R* EB: 1T, 1R	Caltrans
Pomerado Road/ Highland Valley Road	Signalized SB: 1L, 2T, 1R WB: 1LT, 1R NB: 1L, 1T, 1TR EB: 1L, 1LT, 1R	Signalized SB: 2L, 1T, 1TR WB: 1LT, 2R NB: 1L, 2T, 1R EB: 1L, 1LT, 1R	City of San Diego
San Pasqual Road/Bear Valley Parkway	Signalized SB: 1L, 2T WB: 2L, 1R NB: 2T, 1R	Signalized SB: 1L, 3T WB: 2L, 1R NB: 3T, 1R	City of Escondido
San Pasqual Valley Road/SR-78/Bandy Canyon Road	Unsignalized WB: 1LT NB: 1LR EB: 1TR	Unsignalized WB: 2T, 1L** NB: 1LR EB: 1T, 1TR	Caltrans

LEGEND:

L = Left-turn lane T = Through lane R = Right-turn lane TR = Through + right-turn lane LT = Left-turn + through lane LR = Left-turn + right-turn lane
si = Shadow-left-turn lane for intersection geometric design. Not included to improve level-of-service. LTR = Left-turn + through + right-turn lane

*Free right-turn lane

**A minimum 14-foot westbound left-turn lane should be provided in order to have enough shadow/buffer area to provide an acceleration lane for the vehicles making left-turn from northbound Bandy Canyon Road to westbound SR-78.

***Recommended intersection configurations needed to accommodate forecasted travel demand.

TABLE 2
SAN PASQUAL EXISTING AND RECOMMENDED INTERSECTION CONFIGURATIONS* (continued)**

Intersection	Existing	Proposed	Responsible Agency
San Pasqual Valley Road (SR-78)/Bear Valley Parkway	Signalized SB: 1L, 1T, 1TR WB: 1L, 1T, 1TR NB: 2L, 1T, 1TR EB: 1L, 2T, 1R	Signalized SB: 1sl, 1L, 2T, 1R WB: 2L, 1T, 1TR NB: 2L, 2T, 1R EB: 1L, 2T, 1R	County of San Diego Caltrans
San Pasqual Valley Road (SR-78)/Cloverdale Road	Unsignalized WB: 1L, 1T NB: 1L, 1R EB: 1TR	Signalized SB: 1L, 1TR WB: 1L, 1T, 1TR NB: 1L, 1TR EB: 1L, 1T, 1TR	Developer (Eaglecrest) City of San Diego Caltrans County of San Diego
Via Rancho Parkway/I-15 NB	Signalized SB: 1L, 2T, 1R WB: 2L, 3T, 1R NB: 1L, 2T, 2R EB: 2L, 2T, 1R	Signalized SB: 1L, 2T, 1R WB: 2L, 3T, 1R NB: 1LT, 1T, 3R EB: 2L, 3T, 1R	Caltrans
Via Rancho Parkway/I-15 SB	Signalized SB: 1L, 1TR WB: 2L, 1T, 1TR NB: 1L, 1T, 1TR, 1R EB: 1L, 2T, 1R	Signalized SB: 1L, 1TR WB: 2L, 1T, 1TR NB: 1L, 1T, 2R EB: 1L, 2T, 1R	Caltrans
Via Rancho Parkway/Old Pasqual Road	Unsignalized SB: 1LT WB: 1LR NB: 1TR	Signalized SB: 1L, 2T WB: 1LR NB: 1T, 1TR	City of San Diego
Via Rancho Parkway/Sunset Drive	Signalized SB: 1LT, 1R* WB: 1L, 3T, 1R NB: 1L, 1TR EB: 2L, 2T, 1TR	SB: 1sl, 1T, 1R* WB: 2L, 3T, 1R NB: 2L, 1TR EB: 2L, 3T, 1R	Developer (Shopping Centers/Via Rancho Parkway) City of Escondido

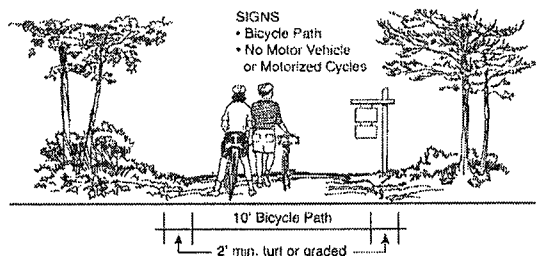
LEGEND:

L = Left-turn lane T = Through lane R = Right-turn lane TR = Through + right-turn lane LT = Left-turn + through lane LR = Left-turn + right-turn lane
 sl = Shadow-left-turn lane for intersection geometric design. Not included to improve level-of-service. LTR = Left-turn + through + right-turn lane

*Free right turn lane

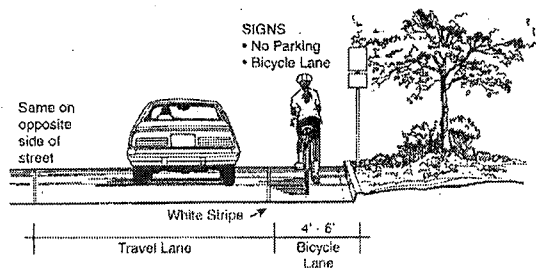
**A minimum 14-foot westbound left-turn lane should be provided in order to have enough shadow/buffer area to provide an acceleration lane for the vehicles making left-turn from northbound Bandy Canyon Road to westbound SR-78.

***Recommended intersection configurations needed to accommodate forecasted travel demand.



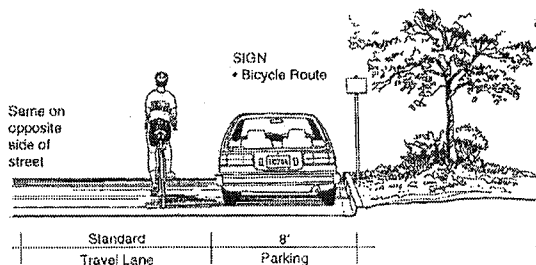
CLASS I
(Typical location - open space)

Bicycle Path
A completely separate right-of-way for the exclusive use of non-motorized vehicles.



CLASS II
(Typical location - major street)

Bicycle Lane
A restricted right-of-way located on the paved road surface alongside the traffic lane nearest the curb, and identified by special signs, lane striping, and other pavement marking.



CLASS III
(Typical location - neighborhood street)

Bicycle Route
A shared right-of-way designated by signs only, with bicycle traffic sharing the roadway with motor vehicles.

The dimensions illustrated on this page are subject to change.



Bicycle Facilities and Classifications

San Pasqual Valley Plan

13
FIGURE

ACTION PLAN

Implementation Measures	Recommended Timing			Responsibility for Implementation	Source of Funding	See for More Detail
	Adopt with Plan	Ongoing	Within 15 Years			
Delete SA-603 from Community Plan and general Plan	•			Planning Department, City Council	Water Utilities Department	Proposal 1
Require provision of bikeways during park design and street improvement process		•		San Dieguito JPA, Engineering Department	Bond, Unidentified, CIP*	Proposals 2, 3, 4
Make street and intersection improvements			•	Engineering Department	N/A	Proposals 2, 3
*Capital Improvement Program						

COMMUNITY FACILITIES AND SERVICES

BACKGROUND

There are limited community facilities and services located within the San Pasqual community. The need for most public facilities and services is driven by development and the associated population growth. Since the majority of the San Pasqual community is a designated agricultural and open space preserve, development within the community will be limited and facility needs minimal. However, public facilities and services are available in surrounding communities. Any future community facility needs in San Pasqual may be best met by sharing, or co-locating, facilities outside the valley.

There is one public school in the community, the San Pasqual Union School. It is both an elementary and middle school, offering classes from kindergarten through eighth grade with a capacity of approximately 250 students. The school is operated by the San Pasqual Union School District. High school classes are provided by the Escondido School District at the San Pasqual High School. The San Pasqual Adventist Academy, a private school located outside the community plan area in the County of San Diego, is owned and operated by the Seventh-Day Adventist Church.

No libraries are located in the community. Mobile library service is provided every other week by the County of San Diego through the Serra Cooperative System. The mobile library serves the community from the San Pasqual Union School parking lot. Other libraries are located in the adjacent community of Rancho Bernardo and the city of Escondido.

Police services are provided by the City of San Diego Police Department out of the Northeastern Area substation located in Rancho Penasquitos at 13396 Salmon River Road. The community is patrolled by Beat 214, which also includes Rancho Bernardo and Bernardo Heights.

Fire services are provided by the City of San Diego Fire Department from Station 33 located in the Rancho Bernardo Community. The City has an Automatic Aid Agreement with the San Pasqual Volunteer Fire Department (CSA 119) located on county land in the heart of the San Pasqual Valley. The City also has mutual aid agreements with the city of Escondido and the California Division of Forestry Fire Station located in Ramona.

No water and sewer services are provided. All development uses well water and provides independent septic tank services.

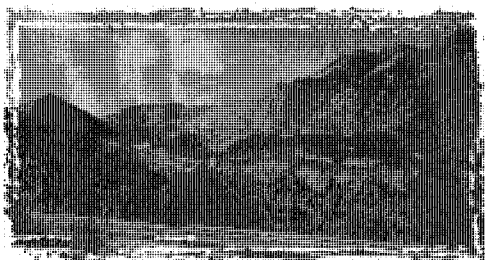
GOAL

Public facilities and services provided concurrent with community need

POLICY

The City shall pursue the co-location of public facilities, with other jurisdictions when it is cost-effective and serves the greater public welfare.

Appendices



- Legislative Framework
- Relationship to General Plan
- Plan Update and Amendment Process
- Annexations and Detachments
- Design and Development Standards
- Mitigation, Monitoring and Reporting Program

APPENDIX A. LEGISLATIVE FRAMEWORK

The San Pasqual Valley Plan was developed within the context of a legislative framework existing on federal, state and local levels. Among the more important areas of influence are:

- Section 65450 of the Government Code of the State of California (State Planning and Zoning Act) which gives authority for the preparation of the community plan and specifies the elements which must appear in each plan. It also provides means for adopting and administering these plans.
- The California Environmental Quality Act of 1970 (CEQA), as amended, which requires that environmental documents be prepared for all community plans. Separate, detailed environmental impact reports are also required for all projects which may adversely affect the environment, including actions related to implementing the plan.
- The Regional Air Quality Strategy (RAQS) was developed in 1977 to achieve a level of air quality in the San Diego Air Basin that would meet federal air quality standards set forth in the National Clear Air Act. A major recommendation pertinent to this planning effort is to include air quality considerations in all land use and transportation plans.
- The Progress Guide and General Plan of the City of San Diego establishes citywide goals, guidelines, standards and recommendations which serve as the basis for the goals, objectives and recommendations of the community plan.
- The citywide zoning and subdivision ordinances, which regulate the development and subdivision of land in the City.
- In addition to legislation and ordinances, the City Council has adopted a number of policies to serve as guidelines in the decision-making process. Many of the policies relate directly to planning issues and are used in implementing plan recommendations.

APPENDIX B. RELATIONSHIP TO THE GENERAL PLAN

The San Pasqual Valley Plan is a component of the General Plan. Public Resources Code Section 21083.3 requires that a community plan include or reference the eight mandatory elements of a general plan:

- Land Use
- Circulation
- Housing
- Conservation
- Open Space
- Seismic Safety
- Noise
- Scenic Highways

In San Diego, a Transportation Element was developed combining the Noise, Circulation and Scenic Highway Elements. The Safety Element has been incorporated into the discussion of Public Facilities and Services.

The following eight optional elements are also addressed on a citywide basis in the Progress Guide and General Plan:

- Redevelopment
- Cultural Resources Management
- Urban Design
- Energy Conservation
- Recreation
- Industrial
- Commercial
- Public Facilities, Services and Safety

The policies established in the mandatory and optional elements of the General Plan listed above are included in the San Pasqual Valley Plan by reference.

The City of San Diego's community plans comprise the Land Use Element of the General Plan. The San Pasqual Valley Plan contains policies and specific proposals intended to implement the General Plan and to address land use issues unique to the San Pasqual Valley Plan area.

Amendments to the General Plan land use map were adopted to reflect the land use adjustments made as part of the plan update process.

APPENDIX C. PLAN UPDATE AND AMENDMENT PROCESS

While the San Pasqual Valley Plan sets forth many proposals for implementation, it does not establish new regulations or legislation, nor does it rezone property. The San Pasqual Valley is identified as a "Future Urbanizing Area" in the General Plan. Future Urbanizing is one of three "phased-development" categories identified in the General Plan and is applied to large undeveloped areas within the City in order to protect them from premature development. Development in the Future Urbanizing Area may occur in accordance with the underlying A1-10 Zone and CUP provisions of the City's Municipal Code. The approval of a future rezone in the San Pasqual Valley will require public hearings and a phase shift from "Future Urbanizing." The phase shift would have to be approved by the voters as required by the 1985 ballot initiative. One of the Plan proposals will require a rezone and a phase shift to planned urbanizing.

This Plan is not a static document. While it is intended to provide long-range guidance for the orderly growth of the community, in order to respond to unanticipated changes in environmental, social or economic conditions, the Plan must be continually monitored and updated as necessary to remain relevant to community and City needs.

Once the Plan is adopted, two additional steps will follow: implementation and review. Implementation refers to the process of putting Plan policies and recommendations into effect. Review is the process of monitoring the community and recommending changes to the Plan as conditions in the community change. Guidelines for implementation are provided in the Plan, but the process must be based on a cooperative effort of private citizens, City officials and other agencies. The San Pasqual/Lake Hodges Community Planning Group, as well as other private citizen organizations, will provide the continuity needed for an effective implementation program.

APPENDIX D. ANNEXATIONS AND DETACHMENTS

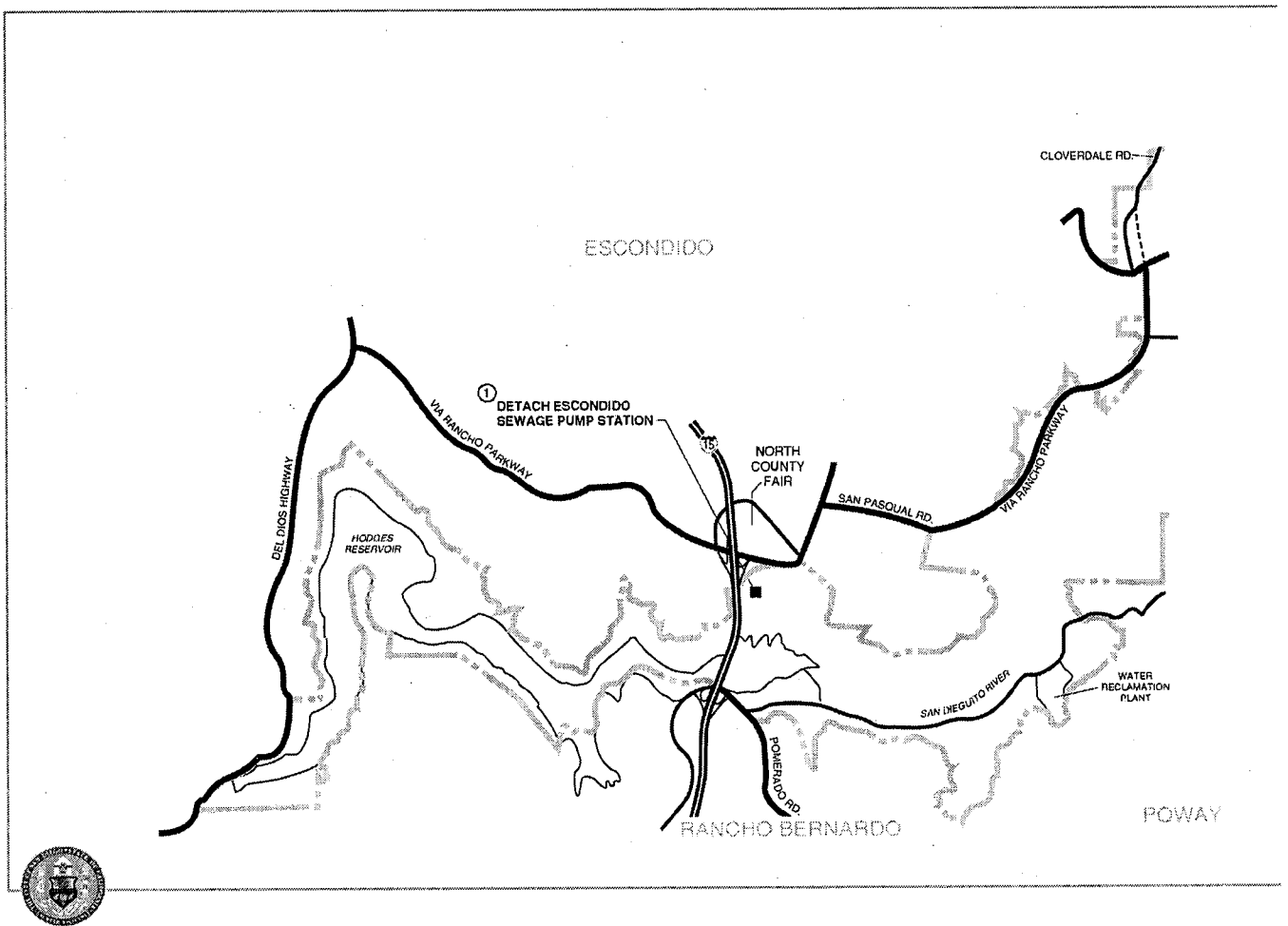
The City of San Diego Water Utilities Department owns a number of parcels of land located adjacent to the San Pasqual Valley Plan area but outside the City's jurisdiction. The annexation of these and other parcels, which would constitute a logical extension of the City's municipal boundary, should be pursued with the Local Agency Formation Commission (LAFCO). LAFCO is an independent, state-mandated agency responsible for reviewing changes in local government organization and boundaries.

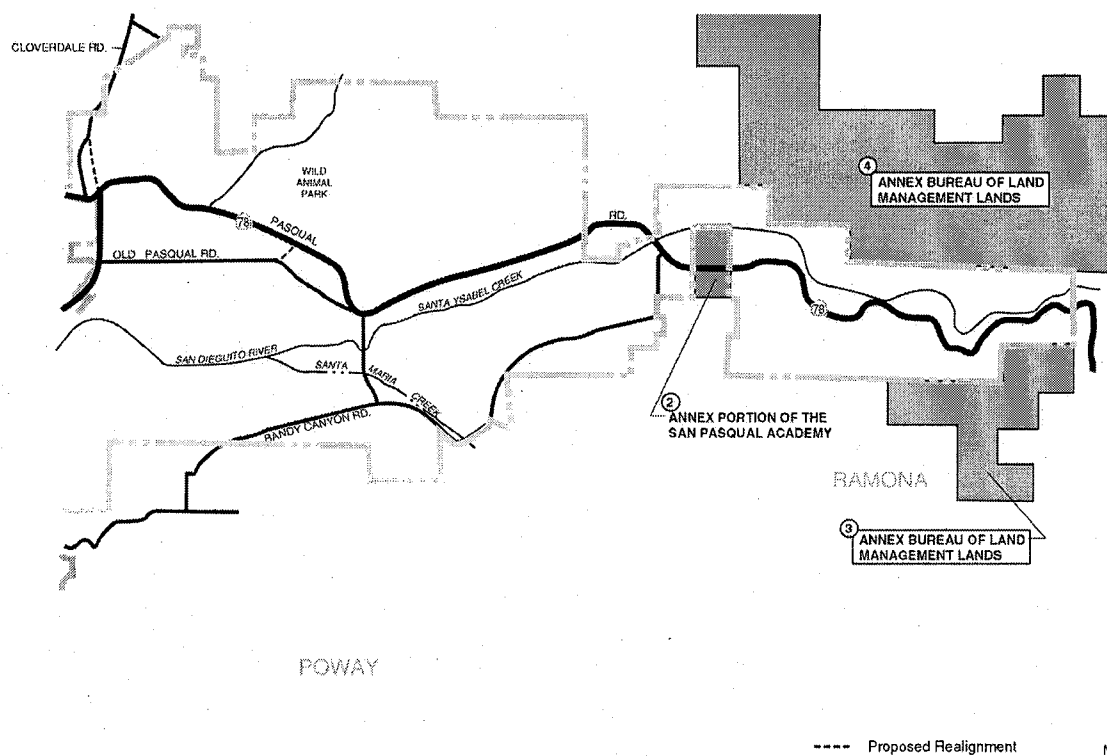
In order for a municipality to apply for annexation, the area proposed for annexation must be predesignated in the municipality's land use plan and be rezoned. The predesignated land use is shown on **Figure 1** and the area is proposed to be rezoned agricultural A1-10.

Three adjustments to the City of San Diego municipal boundary have been identified through the plan update process. Two of the adjustments would annex to the City parcels within the jurisdiction of San Diego County. The other boundary adjustment would detach a parcel to the city of Escondido. Any boundary adjustment would require cooperation between the City of San Diego, the property owner and the adjacent jurisdiction. Ultimately, the boundary adjustment would have to be reviewed and approved by LAFCO.

The proposed boundary adjustments are identified below and illustrated on **Figure 16**.

1. Detach the one-acre parcel containing a pump station owned and operated by the City of Escondido.
2. Annex the approximately 260 acres of the property owned by the San Pasqual Academy, a private boarding school. Annexation of this property would give the City jurisdiction over any future development proposal that could create a land use conflict with agricultural and open space uses on adjacent City property. This property is also located within the riparian corridor proposed by this Plan. If annexation is successful, this property shall be designated for agricultural use, except for the riparian area, which shall be designated as open space.
3. Annex the approximately 2,018-acre Bureau of Land Management (BLM) lands located on the slopes of Clevenger Canyon adjoining the City boundary on the north and on the south. The City and the San Dieguito River Park JPA have developed hiking trails on the BLM lands. The BLM will grant these lands to the City with the condition that they be annexed.
4. Annex the approximately 200-acre Mutual Assets/Harwood properties located to the north of the Wild Animal Park.
5. Annex the three Water Utilities Department-owned properties (approximately 500 acres) located on the western portion of Hodges Reservoir





Proposed Annexations and Detachments
San Pasqual Valley Plan

14
 FIGURE

APPENDIX E. DESIGN AND DEVELOPMENT STANDARDS

All future public and private development will be planned, designed and constructed in accordance with these standards.

The Design and Development Standards are divided into two sections. The first section establishes design and development standards for park and recreation proposals, while the second section establishes basic design and development standards for other public and private development or use proposals within the valley.

Design and Development Standards for Park Proposals

- The form, mass and profile of all structures and architectural features shall be designed to blend with the natural terrain
- Materials, finishes and colors of all buildings, accessory structures, walls and fences should be compatible with the intent of minimizing the visual impact on the valley. Colors should be limited to subtle earthtone hues, with style and texture that reflects the traditional/rural character of the valley
- No park structures shall be constructed over active faults and construction of structures shall adhere to the standards in the Uniform Building Code
- Native species should be the predominant plant material used in park landscape proposals. The use of non-native species, which would most likely be utilized for screening, should be limited to areas located adjacent to developed lands. Under no circumstances should invasive species be utilized
- The use of night lighting should be limited to that required for safety purposes
- Temporary desilting basins shall be provided during construction for projects such as parking lots and interpretive centers in order to trap site-generated sediment on-site. Following the installation of permanent erosion control measures, the desilting basin can be removed
- To avoid long-term erosion problems, all graded areas shall be revegetated and properly maintained for the life of the project
- For paved parking lots located in proximity to an existing natural drainage, the use of grass filter strips, infiltration trenches, or similar established practices, shall be provided to reduce runoff volumes and peak discharge rates from the site, as well as to filter contaminants out of the runoff before it reaches the natural drainage system
- To the extent feasible, existing trails and dirt roads should be used as the adopted alignment for the Coast to Crest Trail and for secondary trails
- Trails should be designed in a manner that will not result in increased runoff velocities
- To the extent possible, a bridge shall be provided where a trail crosses a stream
- Asphalt surfaced trails should not be used adjacent to potable water sources nor within 50 feet of drainages, streams or other surface water bodies

- Wherever possible, trails shall follow the contours of the slope, with the cross-slope toward the downhill side of the trail
- The grade of the trail should be less than 15 percent even on steep terrain
- To reduce erosion impacts, the feasibility of using sidehill trail construction should be considered in areas where a trail must pass over steep slopes
- The number and frequency of switchbacks should be minimized due to the erosional problems associated with this type of trail design
- Trail design should incorporate the drainage techniques approved by the U.S. Forest Service, presented in Standard Specifications for Construction of Trails

Design and Development Standards Recommended for Private and Other Public Proposals Within the Valley

Grading

Grading within the valley should be limited to the extent possible and where grading is proposed it should be designed so as to retain the natural shape of the landform and reflect the topographic constraints of the terrain. In all cases mass grading shall be avoided.

Depending on the scale of the project, grading should be phased to allow prompt revegetation to control erosion and visual impacts.

Building pads should be designed to conform to the site topography, including the creation of smaller terraced pads rather than large graded pad areas. In addition, building pads should not be created on the most visible portions of both the ridgelines and the valley floor. The environmental documents prepared for all proposals within the valley should include a visual impact analysis to determine the most suitable location(s) for buildings on a lot.

Where feasible, no structures or construction activity should occur within the 100-year floodplain. Where grading within the valley cannot be avoided, creative grading techniques using contour grading and incorporating existing significant natural features should be utilized. Additional techniques should be implemented including those outlined below.

- Use variable slope gradients with smooth, rounded cuts
- Round off toe and crest of slopes
- Blend graded slope contours with the natural topography
- Utilize native vegetation to alleviate sharp, angular slopes
- Preserve natural and significant geologic features
- Design drainage courses to blend with the environment
- Use serrated grading techniques to help guarantee successful revegetation of manufactured slopes

Although the use of retaining walls within view of the valley is highly discouraged, there may be instances in which no alternative is available. In this case, the retaining wall should not exceed six feet in height and should conform to the natural contour of the topography and be screened with indigenous landscaping. Earth tone colors and decorative natural materials such as stone construction should be used to blend with the natural landscape.

Roadways should be designed to minimize grading and visual impacts. The use of non-typical standards for roadway design should be considered as necessary to accomplish this, subject to the approval of the City Engineer. Roadways and driveways should be located in areas with the least visual and environmental impacts on the valley. Landscaping should be provided to buffer roadways and driveways as viewed from the valley. This landscaping shall be indigenous to the maximum extent possible.

Any parcels that have been disturbed by illegal grading should be restored through corrective grading techniques and/or revegetation of the native habitat.

Structural Design

Within the valley, the form, mass and profile of the individual structures and architectural features should be designed to blend with the natural terrain.

Structures should be set back from ridges and bluffs throughout the valley to reduce their visual impact. Where development on hillsides cannot be avoided due to existing ownership patterns, the proposed design should preserve the character and profile of the natural slope.

Materials, finishes and colors for all buildings, accessory structures, walls and fences, should be compatible with the intent of minimizing the visual impact on the valley. Colors should be limited to subtle earth tone hues, with style and texture that reflects the traditional/rural character of the valley. Colors should not be bright, reflective, metallic or otherwise visually out of character with the natural setting. The use of red tile roofs along ridgelines should also be discouraged. In addition, colors such as white or pink that contrast with the landscape, should be avoided. The use of natural materials is encouraged.

The visible area of the buildings and uses should be minimized through a combined use of regrading and landscaping techniques.

Structures should be generally low in profile and utilize upper story setbacks so as not to be visually prominent as viewed from within the valley floor.

The use of stem walls should be avoided.

The facades of structures should be angled at varying degrees to follow the natural topography of the site. Rooflines of structures should vary in angle and height to provide a changing profile. Rooflines shall emphasize the natural landforms and help blend the structures into the natural open space environment.

Accessory uses such as tennis courts, gazebos and swimming pools that would require retaining walls and/or extensive structural supports visible from the valley should be avoided. Accessory uses should be set back from the ridgeline and properly screened with landscaping to be unobtrusive. In deck construction, large distances between structures and grade shall be avoided.

The use of exterior lighting should be limited to that needed for security purposes. If proposed, lighting should be a low-sodium type with horizontal cut-off and shall be shielded downward such that the light would not be visible to adjacent properties. A site lighting foot-candle diagram may be required to demonstrate conformance with this guideline.

Subdivision Design

Where a subdivision is included within the valley, all development should be clustered outside of the viewshed of the valley to the extent possible.

Subdivisions should be designed to minimize encroachment into the valley. Subdivision design should be required to protect the existing significant environmental/cultural resources by minimizing grading, drainage and overall impacts in the valley. Areas remaining in open space should be protected by open space or conservation easements.

Open space linkages should be required for pedestrian/bike traffic and equestrian trails linking the project with the valley's proposed trail system.

Development should also be clustered to maximize the amount of open space within the valley.

Projects should be designed to provide appropriately sized open space linkages where deemed necessary to allow for wildlife movement and trail linkages.

All projects should protect significant view corridors to the river valley and open space areas.

Hillside development should blend rooflines with the profile of the land. Retain as much existing vegetation as possible. Upon completion of grading, impacted areas shall be replanted. Native plant species should be used to the extent feasible and should consider brush management and the interface with the natural environment.

Roadway crossings of the open space corridor should only be permitted if designated in the transportation element of the General Plan or applicable community plan.

Fencing

To reduce the need for property line fencing on major slopes, subdivisions should be designed to place major slopes adjacent to proposed building pads in separate open space lots. Where property lines do transverse major slopes, fencing on slopes should be discouraged; however, where such fencing is required the fencing should be visually unobtrusive in color and material.

Fencing should be unobtrusive, typically open and non-opaque when viewed from public areas of the valley, with natural colors to blend with landscape.

Landscaping

Drought tolerant and native species should be used wherever possible to minimize water usage and maintain the natural shape and rural character of the environment. Landscaping should make a gradual transition from ornamental to native vegetation.

Existing mature, native trees and shrubs, natural rock outcroppings and riparian areas should be preserved and special measures should be taken during any grading and construction activity to ensure that no unanticipated impacts will occur.

Structures and improvements should be located so as to minimize removal of trees and existing vegetation.

Planting along the slope side of development should be designed to allow controlled views out, yet partially screen and soften the architecture. Tree species selection and placement should be designed to be capable of exceeding the height of the top of the slope.

Clearing for firebreaks and planting of non-native, fire retardant vegetation should occur so that the area is not within the viewshed of the valley. Sensitive fire suppression landscape designs to provide necessary protection while striving to maintain the visual and biological integrity of the native plant communities should be utilized in accordance with the following:

- Maintain adequate building setback
- Locate irrigation at top of slope
- Thin out high and moderately flammable species
- Remove dead branches, foliage and other debris
- Remove limbs touching the ground
- Separate plant groupings and avoid dense plantings of tall species, maintain existing plants in random
- Prune selectively to maintain natural appearance
- Hydroseed with native, low-growing plants and grasses
- Landscaping should make a gradual transition from private yard to native vegetation
- Landscaped areas within the valley should use native vegetation

Drainage And Erosion Control

A runoff control plan, which would minimize runoff from the site, should be submitted as part of the site plan.

Natural and historic runoff patterns and water velocities into the river valley should be maintained where feasible.

Runoff velocity should be non-scouring, non-erosive and of a degree such that no armoring (e.g. rip-rap or concrete) of a channel is required.

To minimize erosion and siltation, areas of disturbance during construction should be stabilized as rapidly as possible with non-invasive vegetation. Temporary and permanent erosion and siltation control measures as necessary should be installed to minimize construction and development impacts.

All runoff control structures and devices, including detention/retention basins, siltation traps, catch basins, energy dissipaters and outfalls should be shown on the site plan and should conform to all other design regulations herein.

The peak rate of runoff from the site in post-development conditions should match the peak rate of runoff from the site in pre-development conditions for all design storms. Detailed drainage calculations should be provided as necessary to ensure compliance with this requirement.

All development must utilize best management practices for control of storm water pollution in conformance with the City of San Diego's NPDES Storm Water Permit Program and the Water Utilities Department's requirements for watershed protection.

Runoff and erosion control techniques should be based on techniques outlined in the Erosion and Sediment Control Handbook, California Department of Conservation and in the National Engineering Handbook, United States Agriculture Soils Conservation Service.

APPENDIX F. MITIGATION, MONITORING AND REPORTING PROGRAM (MMRP)

(DEP NO. 94-0070) ADDITIONAL RECOMMENDED MEASURES

The MMRP for the San Pasqual Valley Plan consists of those goals, policies, and specific proposals that would contribute to avoiding, mitigating, or lessening the impacts that have been identified in the Environmental Impact Report. Additional measures have been recommended by the Environmental Analysis Section of the City Development Services Department, and they have been incorporated into the Plan.

Due to the general nature of a plan update, additional environmental review will be required as development of specific projects occurs over time. Additional mitigation measures with a greater degree of specificity will be developed within the framework of this MMRP.

To avoid duplication of information, only the following additional recommended measures are set forth in this appendix. The goals, policies and specific proposals that are a major part of the MMRP are contained in the text of the Plan.

ALL ISSUE AREAS

A. Land Use

Future projects shall be developed in accordance with the provisions of all applicable environmental and land use regulations. These include but are not limited to the Resource Protection Ordinance (RPO) and the Hillside Review Overlay Zone (if appropriate).

B. Water Quality

Measures for avoidance of agricultural impacts on water quality may include but are not limited to proper tillage practices, the use of grass filter strips, runoff detention basins, chemical spill catchment basins, proper use of chemicals and fertilizers, use of new and less impacting products, encouragement of organic farming and monitoring of farming practices by the City.

Appropriate best management practices shall be developed on a case-by-case basis by the City's Agricultural Assets Manager and the lessees in coordination with the Water Utilities Department.

C. Hydrology

Runoff into Lake Hodges resulting from new development shall be avoided through design and implementation of devices such as "first flush" systems and detention basins.

The use of recycled water for non-potable uses such as irrigation shall be encouraged.

D. Water Conservation

Water conservation measures may include requiring the use of drip irrigation systems and drought-tolerant landscaping.

E. Biological Resources

Future projects shall be developed in accordance with the provisions of the RPO and Hillside Review Overlay, as applicable.

Mitigation measures for biological impacts may include but are not limited to on-site preservation if resources are within proposed habitat preserve boundaries; restoration of impacted vegetation through revegetation at a suitable ratio combined with monitoring and reporting programs; acquisition of offsite mitigation land; and contributions to a mitigation bank. Impacts to coastal sage scrub or other California gnatcatcher-occupied habitat shall be subject to the Interim Habitat Loss Permit Process in the short term. Once the MSCP is adopted, projects shall be required to comply with the open space designation and mitigation guidelines of the approved plan or equivalent.

The proposed recreational trail shall be designed so as to avoid sensitive biological resources.

F. Cultural Resources

All future development projects and leases shall be subject to project-specific environmental review to determine potential impacts to cultural resources and associated mitigation measures in accordance with the California Environmental Quality Act (CEQA) and, when applicable, with the RPO.

In cases where federal funds, land, and/or discretionary authority are involved, cultural resources shall be evaluated for eligibility for inclusion in the National Register of Historic Places.

Appropriate Native American representatives shall be identified and consulted regarding potential Native American concerns in the early stages of project development located on City-owned land, and thereafter as appropriate.

The proposed recreational trail shall be designed so as to avoid known significant cultural resources.

G. Traffic and Circulation

Planning and environmental analysis efforts related to SR-78 shall be coordinated with the California Department of Transportation.

H. Geology/Soils

For new residential or commercial structures, detailed mitigation plans or alternatives for erosion impacts shall be formulated during site-specific environmental review.

I. Noise

Measures to avoid significant noise impacts may include but not be limited to construction of noise attenuation walls and design to roadways to incorporate intervening topography.

J. Community Services/Public Utilities

Any new development proposals shall be reviewed by the appropriate City departments, other agencies and SDG&E.

Measures to avoid or reduce impacts on public services and utilities may include but are not limited to provision of additional equipment and funding for fire and police services where necessary. If new development requires new or increased water and/or sewer service, provisions shall be made to ensure that the system is adequate and that water quality impacts are avoided.

Brush management shall be encouraged where it is needed, and shall be coordinated with appropriate agencies.

Implementation of the above measures, along with the goals, policies, and proposals contained in the Plan text, will partially reduce identified impacts, although in some cases not to below a level of significance. Impacts are considered significant and not fully mitigated until future development and implementation of project-specific mitigation, monitoring and reporting programs.



<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>
Last updated on 06/21/2011

Clean Energy

You are here: [EPA Home](#) [Climate Change](#) [Clean Energy](#) [Clean Energy Resources](#)
Greenhouse Gas Equivalencies Calculator

Greenhouse Gas Equivalencies Calculator

UPDATED May 2011. New NYUP sub region and national average non-baseload emissions rates updated. See the [revision history page](#) for more details.

Did you ever wonder what reducing carbon dioxide (CO₂) emissions by 1 million metric tons means in everyday terms? The greenhouse gas equivalencies calculator can help you understand just that, translating abstract measurements into concrete terms you can understand, such as "equivalent to avoiding the carbon dioxide emissions of 183,000 cars annually."

This calculator may be useful in communicating your greenhouse gas reduction strategy, reduction targets, or other initiatives aimed at reducing greenhouse gas emissions.

Other Calculators

There are a number of other web-based calculators that can estimate greenhouse gas emission reductions for

- individuals and households
- waste, and
- transportation.

For basic information and details on greenhouse gas emissions, visit the Emissions section of EPA's climate change site.

Enter Your Data Below

There are two options for entering reduction data into this calculator.

Option 1: If You Don't Have Emissions Data

1. If you are starting with data in units of "gallons of gasoline consumed," "kilowatt-hours of electricity," "therms of natural gas," or "passenger vehicles per year" instead of a quantity of emissions of specific greenhouse gases, use this option.
2. Enter a quantity and pick the desired unit below; and
3. Click on the "Calculate Equivalent" button to convert your value to [Carbon Dioxide Equivalent](#).
4. If you are entering kilowatt-hours of electricity, please be sure to read the caveats and explanations on the [Calculations and Reference page](#).
5. Please note that these estimates are approximate and should not be used for emission inventory or formal carbon footprinting exercises.

[? Click Here for Calculations and References](#)

Option 2: If You Already Know the Quantity of Emissions

If you have already estimated the quantity of emissions (e.g., metric tons of carbon dioxide equivalent), you can input the amount of emissions and select the appropriate units for the

corresponding greenhouse gas type.

Amount	Unit	Gas
1,846	Metric Tons	CO ₂ - <u>Carbon Dioxide or CO₂ Equivalent*</u>
	Metric Tons	<u>Carbon or Carbon Equivalent</u>
	Metric Tons	CH ₄ - <u>Methane</u>
	Metric Tons	N ₂ O - <u>Nitrous Oxide</u>
	Tons	HFC-23 - <u>Hydrofluorocarbon gases</u>
	Tons	CF ₄ - <u>Perfluorocarbon gases</u>
	Tons	SF ₆ - <u>Sulfur Hexafluoride</u>

Calculate Equivalencies

Clear Fields

*If your estimated emissions of methane, nitrous oxide, or other non-CO₂ gases are already expressed in CO₂ equivalent or carbon equivalent, please enter your figures in the row for CO₂ or carbon equivalent.

The sum of the greenhouse gas emissions you entered above is

1,846 Metric Tons of Carbon Dioxide Equivalent.

This is equivalent to one of the following:

Equivalency Results

Click on the question mark ? link to read the explanation of that particular calculation. [Read about all calculations.](#)

The information you entered above is equivalent to one of the following statements:

Annual greenhouse gas emissions from 362 passenger vehicles ? ([click to read more about this calculation](#))

CO₂ emissions from 206,951 gallons of gasoline consumed ?

CO₂ emissions from 4,293 barrels of oil consumed ?

CO₂ emissions from 24.3 tanker trucks' worth of gasoline ?

CO₂ emissions from the *electricity* use of 230 homes for one year ?

CO₂ emissions from the *energy* use of 160 homes for one year ?

Carbon sequestered by 47,333 tree seedlings grown for 10 years ?

Carbon sequestered annually by 394 acres of pine or fir forests ?

Carbon sequestered annually by 18.3 acres of forest preserved from deforestation ?

CO₂ emissions from 76,917 propane cylinders used for home barbeques ?

CO₂ emissions from burning 10.1 railcars' worth of coal ?

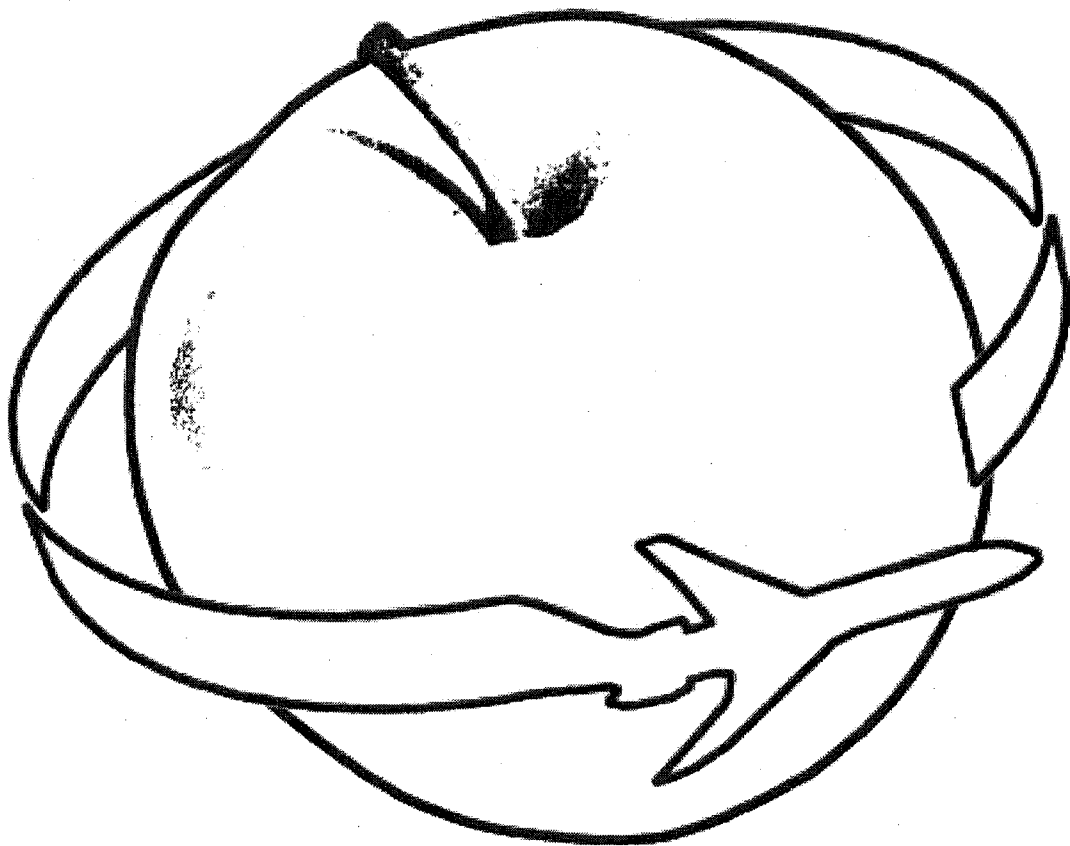
Greenhouse gas emissions avoided by recycling 643 tons of waste instead of sending it to the landfill ?

Annual CO₂ emissions of 0.0004 coal fired power plants ?

Wise Moves

Exploring the relationship between
food, transport and CO₂

Tara Garnett



TRANSPORT
2000
trust

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A few definitions

Here are some of the key terms used throughout the report, together with a brief explanation of what we mean by them. Other definitions, including technical terminology, will be found in the glossary at the end.

Locally sourced or local food: Food whose main ingredients are grown, processed and sold from or within a given radius. The Campaign to Protect Rural England and Waitrose limit this radius to thirty miles; others may adopt a county-wide or less rigid definition. Few, if any, organisations take into account inputs such as agricultural machinery, although many would endorse local sourcing of these where possible.

Sometimes we use the phrase **locally focused or more local** systems. By this we mean an approach which favours sourcing from nearer to hand rather than from national or international sources. It is a relative, non-prescriptive term and could in some cases mean sourcing a product from France rather than from California.

A local store: An independently owned shop or a member of a symbol group or co-operative. Many multiple-owned store formats, such as Sainsbury's Local or Tesco Metro are also 'local.' However, their distribution systems are linked in with those of the retailers' bigger store formats and will be similar, if not identical to them. For

the purposes of this study, and to differentiate clearly between systems to be explored, we do not include these multiple-owned local stores in this definition. We occasionally used the phrase **independently owned store** to clarify the distinction.

Shorter-plus supply chains: An approach in which there is a deliberate attempt to shorten the supply chain, taking into account and balancing geographical distance against other transport-related factors with a bearing on CO₂. This approach strikes a balance between the differences in emissions from different modes of transport (rail, sea, road, air) as well as different types of road vehicle, loading factors, route and so forth.

Lower carbon food: A system focused on delivering lower carbon food is one which attempts to source, produce and supply food in ways that minimise carbon emissions. The ultimate objective is to achieve an absolute CO₂ reduction along the whole of the food supply chain, from plough to plate to landfill site, in keeping with Intergovernmental Panel on Climate Change (IPCC) recommendations. Strategies to minimise CO₂ impacts from transport (including the *shorter-plus* approach, above) will be balanced against those which focus on reducing other life-cycle emissions.

Summary

This report focuses on food miles – what they are, whether and how it might be possible to reduce them and what the consequences of so doing might be.

'Food miles' is a phrase used to encapsulate concerns about the increasing distances our food travels, and the environmental and social consequences thereof.

In this report we consider whether measures to shorten the food supply chain and reduce food miles can help cut CO₂ emissions from transport and, in so doing, achieve an overall reduction in greenhouse gas emissions from the food system.

The Intergovernmental Panel on Climate Change states that we need to achieve a 60–80% cut in human-generated greenhouse gas emissions.¹ All sectors, including the food industry, will have to make a proportionate contribution to achieving this goal.

Food: The wider social and environmental context

Few people go hungry any more in the UK. The British food industry supplies the collective British stomach with over 40,000 different products, sourced from around the world, seven days a week, 24 hours a day. Most of us have access to an abundance of cheap food, provided by a food industry which, once the farming, manufacturing and retail sectors are combined, collectively employs around 12.5% of the workforce, contributes 8% to the economy,² and is delivered by a logistics system that many claim to be the most efficient in the world.³

Nevertheless, the food system also places very significant burdens on our society and the

environment. One study estimates the food chain's contribution to greenhouse gas emissions to be at least 22% of the UK total.

The Government's sustainable farming and food strategy, *Facing the Future*, puts agriculture's contribution to UK emissions at 7.5%⁴ while its 2000 Climate Change report has it even higher, at 12%.⁵

Environmental and other critics of the food industry increasingly advocate a food system based on the principles of localism. They claim that such a system would help provide consumers with seasonal food produced mainly, but not exclusively, from within a given locality, at prices which reflect the true (including socio-environmental) costs of production and which give farmers a fair return for their efforts. They also argue that such a system would help cut CO₂ emissions from food transport and that this in turn would lead to an overall reduction in emissions from food.

These claims are contested by the food industry and by many policy makers. As there is little by way of conclusive evidence on either side, we sought, in undertaking this piece of work, to shed some light on the issue.

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- 1 *First Assessment Report*, Intergovernmental Panel on Climate Change, Geneva, 1990
 - 2 *The Strategy for Sustainable Farming and Food: facing the future*, Department for the Environment, Food and Rural Affairs, 2002
 - 3 *UK Retail Logistics Overview*, Factsheet, Institute of Grocery Distribution, January, 2003 www.igd.com/default.asp?CIR/secondlevel_fs.asp|menuid=26
 - 4 *Facing the Future: the strategy for sustainable farming and food*, DEFRA (1990 figures)
 - 5 *Climate Change: the UK programme*, DEFRA, 2000

Are things getting better or worse?

Is the food sector becoming more or less transport intensive and what are the implications for CO₂ emissions?

Perhaps the most important point to make is that food movements taking place outside the UK are not included in UK Government transport statistics, nor are the emissions they generate captured in the UK's greenhouse gas inventory. Indeed, those produced by aircraft and ships are attributed to nobody, meaning that there is little regulatory incentive to reduce them.

Emissions generated by road vehicles overseas carrying food destined for British stomachs will count towards the host country's annual greenhouse gas bill, not to the UK's. The reverse is also true; emissions produced trucking British products across the UK before they depart our shores for foreign markets will be included in the UK's balance. However, since we import much more food than we export – the UK is a net importer of food – the greenhouse gas imports/exports equation does not balance out. It is striking that, in contrast with the UK, the growth in freight transport in the European Union (EU) is outstripping growth in Gross Domestic Product (GDP).⁶ This is true also of the growth in global freight transport.⁷ For food journeys, this discrepancy suggests that we are driving our food on other nations' roads more than our own, and more than ever before.^{8,9} As a result our food system is generating growing but, as far as the UK balance sheet is concerned, *hidden* quantities of transport-related CO₂ emissions.

The vast majority of food entering and leaving the UK will travel by ship, following a road journey in its country of origin. However, we are also seeing a rapid growth in the air-freighting of food, the vast majority of which flies in on dedicated freight aircraft rather than in the spare space or 'belly-hold' of a passenger aeroplane.

Within the UK almost all our food travels by lorry; rail accounts for less than 1% of food moved, measured in tonne-kilometres.¹⁰ There are some indications that the growth trajectories of food transport within the UK and the CO₂ emissions this transport generates may be diverging. In absolute terms, however, food transport measured either in vehicle-kilometres or in tonne-kilometres still continues to grow.

In addition to greenhouse gas emissions, the transport of food by air, sea and land is also responsible for a number of other social and environmental problems, including air, sea and land pollution, human health impacts, road injuries and deaths, land take and consequent loss of biodiversity, and a less quantifiable but nevertheless important decline in the quality of life for many people.

Will technology solve the problem?

Much policy emphasis has been placed on promoting the development and adoption of cleaner technologies, more efficient driving and management practices and the use of rail and short sea shipping for freight transport.

The adoption of these technologies and practices can help achieve very significant reductions in greenhouse gas emissions. Important savings are already being made.

The fact remains, however, that whatever the gains in efficiency, more goods are being transported further and more frequently than ever before, leading to an absolute increase in tonne-kilometres not just in the UK but also, and very importantly, overseas, as a result of our increasingly globalised sourcing strategies. Despite the efficiencies achieved, existing technology is still a very long way off indeed from mitigating this growth.

6 Term 2002 13 EU: freight transport demand by mode, European Environment Agency, http://themes.eea.eu.int/all_factsheets_box

7 Simms A, *Collision Course: free trade's ride on the global climate*, New Economics Foundation, London, 2000

8 Kearney A T, *Insight to Impact: results of the fourth quinquennial European logistics survey*, European Logistics Association, Brussels, 1999

9 McKinnon A and Forster M, *Full Report of the Delphi 2005 Survey: European logistical and supply chain trends, 1999-2005*, Heriot-Watt University Logistics Research Centre, Edinburgh, 2000

10 Fowkes T, Senior Lecturer, Institute for Transport Studies, University of Leeds, personal communication, August 2003

Why are we moving things further than ever before?

Perhaps the three key influences which have fostered these globalised supply chains have been political and economic policies, the dominance and influence of food industry players with national and often global reach, and changes in consumer expectations.

The rules governing international trade, together with other economic policies (notably the low cost of transport relative to other production costs), increasing specialisation in the British and global agricultural industries, competition regulations and state aid rules have all favoured the development of international supply chains. They have also made it difficult for governments to internalise external, including transport-related, environmental costs.

Crucial too has been the growth in the power and popularity of a small number of large food retailers and manufacturers. Their appeal lies in their ability to supply consumers, wherever they are, with a very wide range of consistent products, all year round. A product on sale in Glasgow will be identical to one on offer in Slough. Large retailers and manufacturers have achieved this consistency and predictability by concentrating their manufacturing processes and sourcing from around the world, thereby overcoming seasonal or geographical variations and shortfalls.

The consumer has also had a part to play. As a society, we are busier, richer, more culturally diverse, more cosmopolitan, and more individualistic than ever before; and as a result we have come to demand ever more convenient, elaborate and exotic food – all at low cost. The food industry for its part has sought not only to fulfil, but also to anticipate where our desires might lead. This symbiotic relationship between the consumer and the food industry has fostered the development of ever longer supply chains.

Anticipating and preparing for the future

Recent years have seen the emergence of some counters to these globalising trends. At a European level, environmentally focused measures, such as an EU-wide aviation emissions charge, are being considered and in some cases developed. Within the UK, while the broad thrust of Government policy is in favour of further liberalisation and the promotion of international trade, Government has also put in place policies to promote British agriculture. The post-Curry agricultural agenda has spurred on the efforts of the major supermarkets to source and promote UK produce. It may be that in some areas of transport policy too, there are weak incentives for developing shorter supply chains. On the other hand, these may well be cancelled by other policy influences which actively support the development of longer ones. What we may see in future years is the co-existence of separate, parallel supply chains: one for niche local and regional foods; and another, international one, for the vast majority of the goods we eat.

There are also signs that consumer demand for alternatively-sourced foods, or foods with an ethical dimension, is growing. As such, the food miles issue may well grow in importance as part of a package of concerns.

There may also be some commercial arguments in favour of building up more domestic sources of supply as a way of improving the resilience of the supply chain, and preparing for the impact of climate change on existing sourcing patterns.

In the short term, then, the development of shorter or more locally focused supply chains may make sense to some businesses, in some areas, selling certain types of food to certain customers. On the whole, however, and for most foods, the existing globalising trends are likely to continue. It is possible though, that the situation might change more rapidly. A snowballing of concern by consumers about the climate changing actions of major food companies might be one trigger. A more rapid onset of very damaging climate change impacts is another. A terrorist or other threat to the global supply chain structure is a third.

Food, transport and life-cycle carbon emissions: Exploring the relationship

Here we set out to answer three questions.

- First, what contribution do the transport stages of the food chain make to the UK's overall greenhouse gas emissions?
- Second, how do measures to shorten the supply chain affect the generation of greenhouse gases both from transport and elsewhere within the life-cycle of the product? For instance, if you cut mileage, might you increase emissions from agricultural production?
- Third, what difference does the type of retail outlet make to overall greenhouse gas emissions?

Cooking and eating are also considered, but in rather less detail; we ask whether the highly processed foods we are increasingly eating are more or less carbon-intensive than the home-cooked foods that fewer of us now prepare.

Our discussion draws upon two separate research studies that we commissioned as part of the *Wise Moves* project. The first study¹¹ examined various sourcing and distribution options for three products – Braeburn apples, cherries and iceberg lettuce. The second¹² looked at cheddar cheese, white sliced bread and chicken, in whole carcass form. We also base our analysis upon the findings of other relevant studies where these shed further light on the questions we raise.

The studies commissioned by Transport 2000 are not full life-cycle analyses. These require large amounts of time and money, neither of which were available. Instead, the studies focus mainly on calculating transport-generated supply chain CO₂ emissions. For non-transport impacts such as refrigeration they either use generic, publicly available data, or else limit themselves to a qualitative discussion of the likely magnitude of

different impacts. Even these apparently 'simple' analyses were in fact very difficult to perform, partly because of problems accessing data, and partly because the transport stages alone are full of variabilities and uncertainties.

With all these provisos in mind, then, we turn to the first question: how much of a contribution does food transport make to the UK's total greenhouse gas emissions?

Food transport accounts for 3.5% of the UK's total CO₂ emissions, with 2.5% from road haulage and just under 1% from car-based shopping. This 3.5% represents a very significant contribution indeed to the UK's greenhouse gas balance sheet, given that this is simply one life-cycle stage of one industrial sector. Importantly, the figure does not include the unquantified emissions which are generated during the course of transporting foods from overseas. These are not only likely to be considerable, but on the increase.

This said, CO₂ emissions from other life-cycle stages will often be greater than those from transport, at least when it comes to UK produced foods. Agricultural production, food processing and refrigeration can all generate very significant impacts. We need to take action to reduce greenhouse gas emissions at all stages in the supply chain.

As regards the second question, our analysis suggests that there is a complex relationship between transport distance and other life-cycle emissions. It is not a simple question of balancing transport, on the one hand, against other life-cycle impacts on the other. Many hands will be needed: alter one life-cycle area and multiple and complex interactions will occur among all the others, some positive and others not.

Proximity is not always a good measure of carbon sustainability, for three main reasons. First, the mode of transport will affect the calculations. A long journey by sea can be preferable to a shorter trip by road (although it is important to remember that there will also be a road journey before and following the sea crossing). Second, the efficiency of the supply chain is also important and the total energy use will depend on a range of factors including vehicle size, fuel efficiency, whether the vehicle is fully or only partially loaded, the way it is maintained and operated, and the route the vehicle takes. Our study found that one retailer trucks in

11 Mason R, Peckham C, Simons D and Wakeman T, *Wise Moves Modelling Report*, commissioned by the *Wise Moves* project, Transport 2000, June 2002

12 Ecologica, *Wise Moves Modelling Report: sourcing and distribution options for bread, and chicken*, report commissioned by the *Wise Moves* project, Transport 2000, June 2003

cheese from 470 kilometres away but in so doing clocks up fewer transport emissions than another who sources from only 300 kilometres away. It may also be the case that it is not possible to meet demand from within the nearby area. We may be able to meet half the demand for, say, cheese, from within the locality but the rest will still have to come from further afield. This may mean two trucks, each delivering cheese, instead of one fully loaded vehicle.

When it comes to imported foods, however, the importance of distributional efficiency relative to distance is much less. Indeed the research we commissioned into products involving an overseas transport leg (apples, cherries and lettuce) found that the majority of transport emissions were generated before the products even reached the UK. For air-freighted foods in particular, measures to improve distributional efficiency once the food reaches the UK will have a barely discernible effect on overall transport emissions, although this is no argument for inaction.

Finally there are other life-cycle energy impacts to consider. For processed foods the efficiency of the manufacturing plant may carry more weight than its location. It may be less carbon intensive to source fresh unseasonal produce (or produce which cannot readily be grown in our climate) from abroad. In all cases, the point beyond which other life-cycle advantages outweigh the transport disadvantages will depend on the specifics of the production process, the transport mode and other factors.

Importantly, however, we note that the 'trade-offs' work both ways. At times the growth in food transport can be a good benchmark of unsustainability in other areas. Longer supply chains can mean more time spent in refrigerated storage and more goods spoilage, both of which have implications for CO₂ emissions. Shortening the supply chain can help reduce emissions in these other areas.

We also need to consider the potential solvability of various life-cycle problems. There may be more technological scope for 'greening' UK glasshouse horticulture or refrigerated storage through the use of renewable energy than for doing the same with transport. Where this is the case, there will be synergies between reductions in production stage and transport emissions.

It is also important to emphasise that where it appears to be 'better' to source from far away, it may be preferable still not to source that product at all. Bringing winter lettuce in from Spain may use less energy than growing under glass here, but putting something else in our sandwich might be better. Many trade-offs would disappear if we ate more seasonally, suggesting that we need to look more closely at ways of encouraging a shift in consumer demand.

From our analysis then, we conclude that there appears to be some relationship between shorter supply chains and lower transport-related CO₂ emissions although the relationship is by no means simple and will depend on the product in question, the distances involved and the mode and logistical efficiency of transport. We also suggest that there is some correlation between shorter supply chains and lower overall life-cycle CO₂ emissions. For imported foods the relative importance of transport will be much greater than for foods produced in the UK.

In addition to the food miles question, this section also examined the relative efficiency of local shops compared with supermarkets. From the supply chains of the products we examined, the evidence suggests that for a given set of equivalent foods, supermarket transport systems tend to be less carbon intensive than those of local shops. This is not a reflection on the localness or otherwise of the food source, but rather on the question of distributional efficiency. Clearly the multiple retailers have invested large quantities of time, money and expertise in improving the effectiveness of their distribution systems. The supermarkets' logistical advantage lessens somewhat once the shopper trip is taken into account, although only in the case of one product (out of the three studied) does the advantage swing in favour of the local stores. We suggest that for perishable foods, including fresh produce, the advantages of shopping on foot at local stores (this can include multiple-owned local formats) may outweigh the disadvantages of greater logistical inefficiency.

Finally, as regards the cooking question, we highlight in our discussion a dearth of relevant research on this issue. While we explored some of the arguments for and against each mode of food preparation, our key conclusion was that much more research is needed here.

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We suggest that the features of a lower carbon food system would include the following six elements:

- *Seasonal and indigenous:* Fresh produce grown during its natural growing season and well adapted to UK growing conditions will be less transport intensive and produce fewer overall CO₂ emissions than non-indigenous foods or those imported out of season.
- *Efficient manufacturing:* The processing plant needs to be efficiently operated and managed.
- *Minimal use of temperature controlled storage:* This should not, in the process, compromise safety standards or generate waste through spoilage.
- *Local clustering:* The inputs to the product in question must be situated near to the site of production. For processed foods, it is important that the constituent ingredients can be and are grown or produced near by. For livestock production a nearby source of (among other things) feed and fodder will be important. There are also downstream connections to consider – in the case of livestock this will be the location of the abattoir, the cutting rooms and so forth.
- *Journey distance:* The distance from point of production to point of retail to point of consumption should be minimised.
- *Logistical efficiency:* The fuel efficiency of a vehicle and the way it is managed and operated are very important. In addition loads must be consolidated and vehicles as full as possible while they are in use.

A lower carbon food system: Towards a way forward

The status quo is not sustainable. It is important to be very clear about this. Despite the gains in efficiencies that have been achieved, the magnitude of the problem we face dwarfs them.

We have identified the six elements, or characteristics of a lower carbon food system above. Developing a food system which contains these elements will be challenging, but not

impossible. What might such a system look like in practice and what policy direction might we need to take in order to shape it?

We suggest that a more regionally focused approach to sourcing and distribution can help foster a lower carbon food system. Such an approach would rely upon the development of an invigorated farming sector which works with its regional manufacturing base to supply a regional population with much of the food it needs. Where supplies are not available from within the region, producers from elsewhere within the UK would largely be able to satisfy demand.

We would of course continue to import some foods, because they have come to be seen as essential and a part of our food culture, or because there are benefits, in terms of carbon reduction, from so doing. A sustainable (as opposed to simply low carbon) food system will also have to balance carbon reduction objectives against other wider social and environmental issues, such as support for developing countries through fair terms of trade. These considerations are, however, beyond the remit of this report.

In our view, a regional approach offers more CO₂-reducing potential than either globalised systems or very local ones. We highlight in the report some of the problems of globalised systems. As regards local systems, it will not always be possible to grow and produce a sufficient variety of foods locally in sufficient quantities to meet local needs. As a result, transport journeys from a number of different sources will be needed to meet demand, possibly leading to more transport mileage overall. It is also the case that for some manufacturing processes there are energy efficiency gains to be had from scaling up operations. In addition, we would argue that from a transport perspective at least, a reduction in overseas imports is perhaps the most significant challenge we have to address and as such we should concentrate on this rather than on the final thirty miles or so. This said, there are some particularly fertile and agriculturally varied parts of the UK where a fairly local approach may well be both achievable and environmentally preferable.

Supporting the agricultural supply base would be an efficient and co-ordinated distribution system, involving co-operation among suppliers and

retailers throughout the supply chain. Supporting it too would be a technological infrastructure specifically geared towards reducing carbon emissions and based on renewable or cleaner energy sources. This would enable goods to be grown, manufactured and produced in ways that do not create the potential trade-offs that we highlight elsewhere in the report. Information and Communication Technologies as well as intelligent transport systems would also provide decision makers with the information and other tools they need both to maximise distributional efficiencies and to make sourcing decisions based upon carbon life-cycle analyses of the goods in question.

We also envisage a more diverse retail structure, fostering different patterns of shopping and more seasonal approaches to eating.

This is a somewhat simplistic account of what would undoubtedly be a far more complex picture. It does however highlight the fact that a lower carbon food system is likely to look significantly different from the way things are right now.

To achieve a full 60–80% cut in food-related greenhouse gas emissions, we will need to make very substantial changes in our way of life. However some reductions are better than none at all – we can work towards this goal by making many small shifts in the right direction. Hence the measures we suggest are not intended to be absolutist.

Some indeed build upon policies that are already in place. None of them will work in isolation; a combination of policies is needed. All should of

course be placed in the wider context of a sustainable food agenda.

In short, then, action to foster a lower carbon food system requires movement in the following direction:

- 1 A recognition that the food system needs to reduce the quantities of CO₂ it emits very considerably.
- 2 Policies and measures to reduce carbon emissions throughout the life-cycle of food so that trade-offs become synergies.
- 3 A stronger national and regional food base.
- 4 Measures to shift businesses away from long distance food transport and towards more nationally and regionally based sourcing.
- 5 Co-ordinated and co-operative methods of distributing goods both for the multiples and for local independent stores.
- 6 Information and Communication Technology which assists the development of less carbon-intensive systems.
- 7 Different retail structures.
- 8 Changes in the way we consume.
- 9 Ongoing research.

Finally, industry, government and consumers alike have a choice. We can seek to salvage elements of sustainability from the current system, in order to keep the system going as it is for a little longer. Or we can take a risk, look further into the future, and start to think and do differently. We believe the second route to be the only survivable option.

12 Wise Moves

Introduction

This report focuses on food miles – what they are, whether and how it might be possible to reduce them and what the consequences of so doing might be.

Food miles is a phrase used to encapsulate concerns about the increasing distances our food travels, and the environmental and social consequences thereof.

The food miles debate is complex, straddling both the sustainable food and the sustainable logistics agendas, as Figure 1 shows.

Our report does not attempt to cover all the issues associated either with a sustainable food supply chain or with a sustainable logistics system. We have chosen to limit our discussion to a specific element of the food miles question – its role in generating climate changing emissions.

Some have argued that the long distances which food travels as it makes its way through today's global supply chains, has helped contribute (among other things) to an unsustainable increase

in carbon dioxide (CO₂) emissions. These claims are contested by the food industry and by many policy makers.

As there is little by way of conclusive evidence on either side, we sought, in undertaking this piece of work, to shed light on the issue. **This report considers whether measures to shorten the food supply chain can lead to fewer CO₂ emissions from transport and, in so doing, can help achieve an overall reduction in greenhouse gas emissions from the food supply chain.**

The report is structured as follows:

Section one sets the food miles debate in context, highlighting the relationship between our globalised food system and the many social, economic and environmental concerns with which a responsible food business must engage.

Section two focuses more specifically on food journeys. We ask whether the supply chain is becoming more or less freight intensive over time. We look at where goods come from and

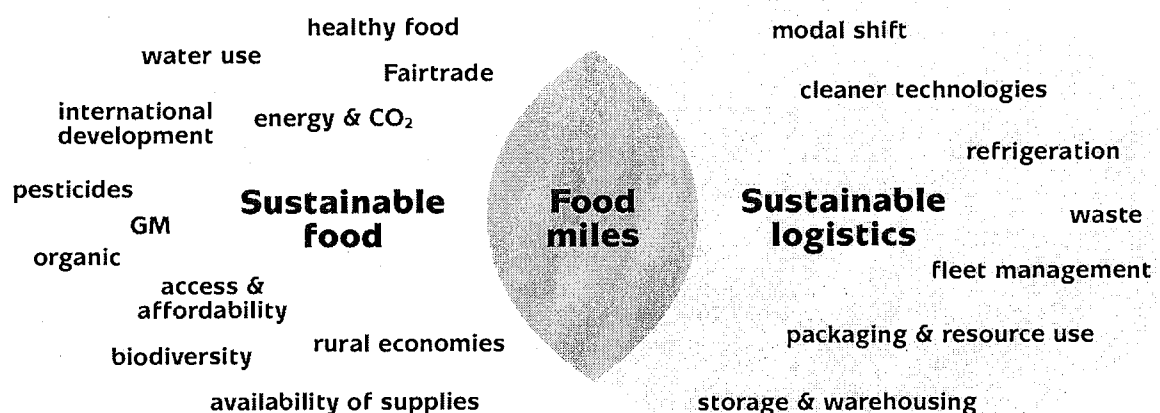


Figure 1

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how they travel, and then discuss the impact that food movements have on climate change. We also touch upon other transport-related social and environmental concerns.

In section three we look at the scope for reducing CO₂ emissions from transport through, among other things, the application of greener technologies, modal shift and better fleet management. We ask whether a focus on improving efficiency is in itself sufficient to tackle the problem of transport generated greenhouse gas emissions.

Section four explores why things are the way they are. We look at the influences – from technological innovations, to trends in our eating habits, to wider economic and political developments – which have all shaped today's food supply chain.

Section five examines likely future trends. Taking a range of issues, from broad geopolitical trends to new directions in consumer demand we ask whether the next few years will see greater pressure on food industries to shorten their supply chains.

Section six is the core of the report. Here we address four questions:

- First, what contribution do the transport stages of the food chain make to the UK's overall greenhouse gas emissions?
- Second, how do measures to shorten the supply chain affect the generation of greenhouse gases both from transport and from elsewhere within the life-cycle of the product? For instance, if you cut mileage, might you increase emissions from agricultural production?
- Third, what difference does the type of retail outlet make to overall greenhouse gas emissions?
- Finally, what about cooking? Do processed convenience foods generate more or fewer carbon emissions than their home cooked equivalents, once energy use at all stages in the food life-cycle is considered?

In section seven we sketch out what a lower carbon food system might look like and discuss what policies we would need in order to realise it.

In section eight, we offer our recommendations.

Annex one summarises some of the arguments made for and against localism. Finally, a glossary is also provided.

Section one

Food in the supply chain

Few people go hungry any more in the UK. While some sections of the population cannot afford the cost of a nutritious diet, most of us have access to an abundance of cheap food, provided by a food industry which, once the farming, manufacturing and retail sectors are combined, collectively employs around 12.5% of the workforce, contributes 8% to the economy,¹³ and is delivered by a logistics system that many claim to be the most efficient in the world.¹⁴

All this is a great achievement. However, precisely because it is so fundamental, the way in which food is produced, distributed, marketed and disposed of touches upon almost every aspect of our society and our environment. Figure 2 (overleaf) shows just some of the issues which affect and which are affected by our food system.

Some impacts are beneficial. Others are not. While cheap at the checkout, it has been argued^{15,16,17} that our industrialised food system is almost incalculably expensive in many other ways.

As regards energy use and CO₂ emissions, the food industry is the UK's third largest industrial energy user, after the engineering and the metals and chemicals industries.¹⁸ Indeed the Government's Working Group on Local Food,¹⁹ cites one report which estimates the food system's contribution to greenhouse gas emissions to be 'at least' 22% of the UK total.²⁰ The Government's sustainable farming and food strategy, *Facing the Future*, puts agriculture's contribution to UK emissions at 7.5%²¹ while the Department for Environment, Food and Rural Affairs (DEFRA) 2000 Climate Change report has it even higher, at 12%.²²

Environmental and other critics of the food industry are increasingly advocating a food system based on the principles of localism.^{23,24}

They claim that such a system would help provide consumers with seasonal food produced mainly, but not exclusively, within a given locality, at prices which reflect the true (including socio-environmental) costs of production and which give farmers a fair return for their efforts. They also argue that a localised system would reduce CO₂ emissions from food transport and that this in turn would lead to an overall reduction in greenhouse gas emissions from the food system.

13 *The Strategy for Sustainable Farming and Food: facing the future*, DEFRA, 2002

14 *UK Retail Logistics Overview*, Factsheet, Institute of Grocery Distribution, January, 2003 www.igd.com/default.asp?/CIR/secondlevel_fs.asp|menuid=26

15 Jones A, *Eating Oil: food supply in a changing climate*, Sustain and Elm Farm Research Centre, London, 2001

16 Lawrence F (ed), *Food: the way we eat now*, three-part special report in *The Guardian*, London, 10, 17 and 21 May 2003

17 *Local Food Economies: the problems, costs and lessons*, keynote presentation by Jules Pretty at *Local Food – Global Experience*, conference organised by the Foundation for Local Food Initiatives, October 2002, www.localfood.org.uk/papers/local-global-conf-report.pdf

18 *Food and Drink Federation's Response to DTI Consultation on Energy Policy*, Food and Drink Federation, London, October 2002

19 *Local Food: a snapshot of the sector*, report of the working group on local food, DEFRA/Food Standards Agency, London, March 2003

20 *Achieving the UK's Climate Change Commitments: the efficiency of the food cycle*, e3 Consulting, 2002. Note: the author includes in his calculations CO₂ emissions from agriculture, food transport, refrigeration and so forth

21 *Facing the Future: the strategy for sustainable farming and food*, DEFRA (1990 figures)

22 *Climate Change: the UK programme*, DEFRA, 2000

23 *Local Food: future directions*, Friends of the Earth, London, November 2002

24 Hines C, *Localisation: a global manifesto*, Earthscan, London, 2002

Many, however, have criticised the localist position, believing it to be based on false premises, Utopian or simply unappealing. They also question, among other things, the assumption that a local food system would lead to the generation of fewer greenhouse gas emissions from the supply chain as a whole, or even to fewer transport-related emissions.

It is the uncertainty surrounding the debate that has given impetus to this *Wise Moves* project.

Annex one summarises some of the arguments for and against localism, for those not familiar with the detail of the claims and counterclaims.

Both sides would, however, acknowledge that food transport has grown, and continues to grow, in absolute terms. In the next section we look at how food journeys are generated along the supply chain and at the social and environmental consequences.

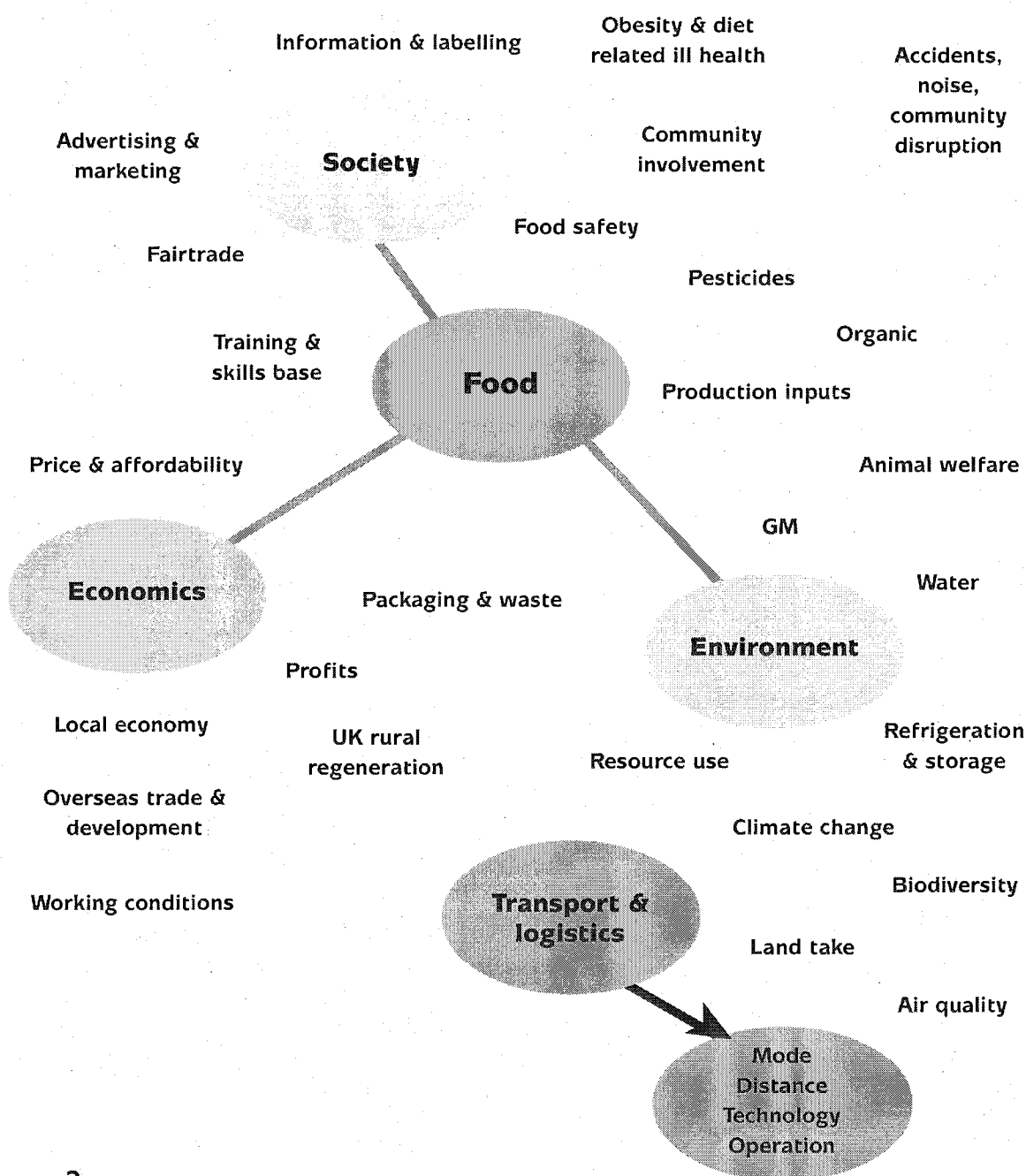


Figure 2

Section two

Food and freight: The trends and their impact

This section explores whether the UK food industry is becoming more or less freight intensive and how freight movements are generated in the supply chain. It goes on to discuss where our food comes from and travels to, and how it gets there. Finally, some of the social and environmental impacts of these movements are examined.

2.1 Food transport: Is the problem growing?

Recent years have seen our society as a whole becoming generally less transport intensive. Growth in UK transport measured in tonne-kilometres has grown more slowly than Gross Domestic Product (GDP).

But is this true of the food industry? Is the food sector becoming more or less transport intensive and what are the implications for CO₂ emissions? Unfortunately, data showing trends in CO₂ from food transport are unavailable. Instead we have to make do with approximations, such as growth in tonne-kilometres and in vehicle-kilometres.

Overseas miles

Perhaps the most important point to recognise is that food journeys taking place outside the UK are not included in UK Government transport statistics, nor are the emissions they generate captured in the UK's greenhouse gas inventory. Indeed, those produced by aircraft and ships are attributed to nobody,²⁵ meaning (as we discuss later) that there is little regulatory incentive to reduce them. Emissions generated by road vehicles overseas carrying food destined for British stomachs will count towards the host

country's annual greenhouse gas bill, not the UK's. The reverse is also true; emissions produced trucking British products across the UK before they depart for foreign markets will be included in the UK's balance. However, since we import much more food than we export, the greenhouse gas imports/exports equation does not balance out.

It is striking that, in contrast with the UK, the growth in freight transport in the European Union (EU) is outstripping growth in GDP.²⁶ This is true also of the growth in global freight transport.²⁷ For food journeys, this discrepancy may suggest that we are driving our food on other nations' roads more than our own – and it is quite possible that we are driving them more than ever before.^{28,29}

As the food industry continues to internationalise its supply chains,³⁰ it seems likely that our food supply system is in fact becoming increasingly transport intensive.

25 Unless the company responsible for these emissions wishes to report them – reporting is still voluntary

26 *Term 2002 13 EU: freight transport demand by mode*, European Environment Agency, http://themes.eea.eu.int/all_factsheets_box

27 Simms A, *Collision Course: free trade's ride on the global climate*, New Economics Foundation, London, 2000

28 Kearney A T, *Insight to Impact: results of the fourth quinquennial European logistics survey*, European Logistics Association, Brussels, 1999

29 McKinnon A, Forster M, *Full Report of the Delphi 2005 Survey: European logistical and supply chain trends, 1999-2005*, Heriot-Watt University Logistics Research Centre, Edinburgh, 2000

30 *The Future of Global Sourcing*, Institute of Grocery Distribution, Letchmore Heath, 2002

Food journeys in the UK

A comparison between growth in GDP and growth in food-related tonne-kilometres shows them to be on a par – over the last ten years the economy has grown by 32% while food freight tonne-kilometres has grown by 30%.³¹ This is in contrast with the freight sector averaged out across all industries, where the rate of growth is only 24%.³² In other words, although this particular set of data suggests that the growth in food transport is slowing off, it is not slowing off as fast as it is in other industries.

A more meaningful and industry-specific comparison might, however, be between growth in the grocery market (by value), and growth in freight tonne-kilometres, in order to assess whether food freight movements are increasing or lessening in proportion with the sector's economic growth.

This approach reveals (using a 1992 baseline) that the 30% growth in food tonne-kilometres is in fact only half the 60% growth in the value of the grocery market.³³ By this measure the grocery sector appears to have become quite significantly less freight intensive. However, once the 60% grocery economic growth figure is adjusted for inflation, the true level of growth reveals itself to be a far more modest 25%. According to this measure, the market has actually grown *more slowly* than the increase in food tonne-kilometres it generates.

Any conclusion is complicated, however, by the fact that like is not being compared with like. The comparison made above is – in the absence of more precise data – between growth in the turnover of the *grocery* sector and growth in *food, drink and tobacco* related tonne-kilometres. These two are not the same: the grocery sector

includes more than food, drink and tobacco. It includes in its definition non-food goods, such as clothing, televisions and cookware. One important reason why the grocery sector has grown so rapidly is because the retailers have moved into selling non-food goods.³⁴ Tesco, for instance, has a 5% share of the UK's non-food retail market.³⁵ These non-food-related kilometres are not included in the food, drink and tobacco tonne-kilometre statistics quoted above. If non-food goods were removed from the calculation we could see a much slower rate of growth within the food industry, meaning again that the growth in transport kilometres outstrips this growth.

The analysis takes on an additional twist once a different measure of freight intensity is used. If, instead of measuring tonne-kilometres, we choose to look at transport growth in terms of vehicle-kilometres, we find that these have grown by only 12% between 1992 and 2002. Growth in vehicle-kilometres has in fact been slower than grocery market growth. This is because food manufacturers and retailers are using larger vehicles than they were before, enabling them to carry more goods for every lorry that travels.

Analysing the data

Which of the two measures is a better gauge of CO₂ emissions – tonne-kilometres or vehicle-kilometres? It is arguable that in this context, the latter is a better choice; while in absolute terms a larger lorry will generate more emissions than a smaller one, per tonne of goods travelled, it will be also relatively less energy intensive. For a given tonnage of goods then, lots of small vans will generate more emissions overall than fewer larger vehicles. A low rate of growth in vehicle-kilometres could therefore be seen as a good thing, from a carbon reduction perspective. One might also add that, in contrast with the freight industry as a whole, most of the multiple retailers have set themselves targets for improving the efficiency of their operations, measured either in terms of kilometres travelled per litre of diesel, or of kilometres travelled per case of product carried.

These factors taken together may in fact suggest (although sector-specific data is lacking here) that the growth trajectories of food transport within the UK, and the CO₂ emissions this transport

31 Figures supplied by the Department for Transport and taken from the *Continuing Survey of Road Goods Transportation* and the Office of National Statistics

32 The decline in manufacturing is probably the main reason for this slow rate of growth

33 Figures supplied by the Institute of Grocery Distribution, Letchmore Heath, 2003

34 *Non Food Retailing 2003*, Institute of Grocery Distribution, Letchmore Heath, 2003

35 *Tesco Annual Review*, 2003 http://81.201.142.254/presentResults/results2002_03/Prelims/Report/site/uk_review.htm

generates, may be diverging. This divergence will be modified by the growth in sales of non-food goods and the growth in tonne-kilometres. Clearly, more data collection and analysis needs to be undertaken before a conclusive answer can be reached.

It is important to stress, however, that whatever the *relative* transport intensity of the food industry, the fact remains that aside from a small, probably foot and mouth disease induced blip in 2001,³⁶ food transport in the UK still continues to grow in absolute terms, whether measured by tonne-kilometres or by vehicle-kilometres.

Moreover, this analysis only applies to UK-based food movements. It is crucial to re-emphasise the importance of including overseas-generated food transport in any assessment of greenhouse gas emissions from the food system. These overseas movements are, as highlighted above, growing rapidly. They also represent, as discussed below, a cause for serious environmental concern.

How is the transport generated?

Movements occur at many stages of the supply chain. For a supermarket, a typical series of food journeys might be as follows:

- Raw ingredients are taken from their source to their place of primary processing. This might include washing and cutting.
- The constituent elements of the end product (both ingredients and packaging) are brought to the manufacturing plant where they are processed and packed. This can involve a number of journeys. The more complex the end product (a ready-made lasagne can contain around 20 different ingredients which may have come from all over the world), the more transport is likely to be involved.
- The finished product may be taken to a consolidation centre where it is consolidated with other goods destined for a number of retailers.
- The consolidated load can travel on to a regional distribution centre (RDC) or a national distribution centre (NDC).
- A full load from the distribution centre travels on to stores.
- Returnable packaging may be backhauled to the distribution centre.
- Supplier products may be backhauled to a national or regional distribution centre during a delivery vehicle's return journey from a store.
- The customers may drive to and from the store, or in some cases the goods may be delivered by van directly to the customer.
- Unwanted goods and unrecoverable waste travel to landfill sites (or occasionally to incinerators), usually by road.

2.2 Food: Where does it come from?

British farmers can produce 62% of the food we eat, or 75% of indigenous type food.³⁷ This makes us – in theory at least – more self-sufficient than we were in the 1950s; for comparison, the figures for 1956 were 47% and 61%³⁸ respectively. However, these figures mask several points. The first is that potential self-sufficiency is on the decline again, since its peak in the late 1980s. The second is that although we may be *capable* of a large degree of self-sufficiency, this does not mean that we eat what we grow. On the contrary, we simultaneously import and export many of the foods we produce, from lamb to butter to carrots. We might export carrots, for instance, when we have a seasonal surplus and import them out of British season. Alternatively we may import marginally different varieties of the same thing, even when UK supplies exist.

The consequence is that the UK remains a net importer of food³⁹ because we are not actually eating the full 62% of what we grow and are capable of producing. In addition to these indigenous foods, we import increasing quantities of foods that cannot be grown or produced here.

36 *Transport Statistics Great Britain*, Department for Transport, London, 2002

37 *Agriculture in the United Kingdom*, DEFRA, London, 2002

38 *Agriculture in the United Kingdom 2000*, MAFF, London, 2001

39 *The Food Industry*, special supplement, *The Grocer*, William Reed Publishing, West Sussex, October 2002. www.grocertoday.co.uk/resources/marketreport.asp?r=410

In 2000 we exported 8.8 million tonnes of food, feed and beverages and imported 17 million tonnes. This compares with 2.9 million tonnes of exports and 6.3 million tonnes of imports in 1980.⁴⁰ In other words, both imports and exports, measured in tonnes, have roughly tripled in the last 20 years.

How much of our food is British?

Data from Sainsbury's reveals that only a third of sales by value were of British food – £6 billion⁴¹ out of £18 billion in sales.⁴² This is despite the company's stated commitment to buying British wherever possible, and its claim that of foodstuffs that can be grown in this country, it sources over 90% from Britain.⁴¹ Sales figures are not entirely proportional to volumes sold or indeed to the calories (or any other nutritional measure) which the consumer ends up eating. On the one hand, it may be that the sales figures for British food are low because these tend to be cheaper commodities, such as bread or milk. The proportion of British food sold by volume may thus be greater than at first appears. On the other hand, the uncertainty works both ways – many foods are imported because they can be and are bought more cheaply from overseas. This is true even of luxury foods such as cherries which, while expensive, are still more cost-effective to import than their British equivalents, once the vagaries of British weather, as well as land and labour costs are taken into account.

When food is imported and exported, most trade is within EU borders, accounting for 58% of our imports and 77% of our exports.⁴³ This has implications for the argument that imported food

may be produced in more energy-efficient ways, because unlike food produced in developing countries, European-origin food is more likely to be produced using machinery and plants similar, and similar in their energy use, to UK equipment. This likelihood lessens for foods from Eastern or Southern Europe where manual labour and, in the latter case, climatic differences may substitute to some extent for fossil-fuel inputs. On the other hand, when fuel-consuming processes are involved, they are likely to be less efficient. A fuller discussion of life-cycle trade-offs can be found in section six.

As for animal feed, although the UK is largely self-sufficient in cereals, we still import soya, maize, molasses and other feedstuffs. These together account for roughly a quarter by weight of all animal feed consumed in the UK.⁴⁴ These inputs to our food system are very important since it is easy to forget that apparently 'British' beef will often have been sustained on feed imported from thousands of kilometres away.

2.3 Food imports and exports: How do they move?

The vast majority of food entering and leaving the UK will travel by ship, following a road journey in its country of origin.

In 2002, 94% (by weight) of the food we imported from non-EU countries arrived by sea, and 1.6% by air; 89% of our exports left by ship, and 1.03% by air. Although a breakdown for EU-origin imports is not available, the figures are likely to be similar because 2000 data for all imports, for all countries, shows that 91% of food (by weight) arrived and left by sea. Less than 1% travels through the Channel Tunnel.⁴⁵ Some of the imports which reach our shore by ship or through the Tunnel will have done so following a rail journey in their country of origin, but while the amount of food moved by rail on the Continent is likely to be higher than in the UK, road's share will still be vastly greater.

Food transport by air

In addition, 0.7% of EU food imports by weight arrived by air and 0.16% left for the Continent by this mode. A look at figures by value changes the

40 HM Customs and Excise. Data prepared by Statistics (Commodities & Food) Accounts and Trade Branch, ESD, DEFRA, 2001

41 See: www.j-sainsbury.co.uk/media/press_questions10.htm

42 Investor FAZQs: www.j-sainsbury.co.uk/investors/ir_questions.htm#9

43 HM Customs and Excise, 2002 data prepared by Statistics and Analysis of Trade Unit, for Transport 2000

44 *Raw Material Usage in Retail Production of Animal Feedingstuffs in Great Britain: May to July 2003*, DEFRA/ONS, 2003 <http://statistics.defra.gov.uk/esg/statnot/mcompnspn.pdf>

45 HM Customs & Excise, 2002 and 2000 data prepared by Statistics and Analysis of Trade Unit, for Transport 2000

picture somewhat – obviously a greater percentage of high value goods will travel by air than by sea. But as demand for these high value products grows it is likely that we will see a very rapid growth in the volume of food transported by this mode.

Food is extremely important to the air freight industry. As the largest air-freighted sector it accounts for 13% by weight of air-freighted goods.⁴⁶ And in the last three years alone total imports of foodstuffs by air have grown by 47% (by value). Exports have grown by 10%.

Contrary to some claims, the vast majority of food flies in on dedicated freighters and not in the belly-hold of a passenger aeroplane.⁴⁷ The reasons for this are apparent. Food is a perishable, high value commodity, with special storage requirements.⁴⁸ Freighters provide a reliable service, flexibility of space (belly cargo is

Air freight: Growth in all sectors

Air freight is growing rapidly: a growth aided by untaxed aviation fuel, by lower manufacturing costs overseas, and by sophisticated communication networks including, recently, the rapid growth in e-commerce.

Although globally 50% of air-freighted goods are carried in the belly of passenger planes that would be flying anyway, the growth in the use of freighters has been significantly higher than the growth in the use of aircraft belly-hold – compare 12.11% per annum growth for freighters with 7.94% for belly-hold.

Furthermore, overall growth in the air freight sector as a whole (particularly to and from Asian markets) is even more rapid than that of passengers, and is predicted to grow at about 6.4% during the next two decades.⁴⁹ Air-freighted goods are worth an enormous amount to the UK economy: while the two million tonnes of air freight that pass through UK airports each year is equivalent to less than 1% of the UK's ocean freight volumes, by trade value it represents around a fifth of British exports.⁴⁹

We are likely to see a global air freight fleet of about 3100 by 2021,⁴⁸ many of which will be retired (and hence less efficient) passenger aircraft. By 2050, freight aircraft could make up nearly a third of the total commercial fleet.⁵⁰

based around very defined container sizes that can not always accommodate pre-packed cargos) and, when properly managed, can work out cheaper than using belly cargo space.⁴⁷

2.4 Food: How does it travel in the UK?

Within the UK, the vast majority of food, whether home-grown or imported, travels by road. Every year we truck 300 million tonnes of food, drink and agricultural products around the country.⁵¹ These movements generate 41 billion tonne-kilometres⁵² and account for 28% of the total tonne-kilometres travelled by freight in the UK. Since 1991 food-related tonne-kilometres has grown by 26.6% compared with an average 20% across all freight sectors.⁵³

This 28% share of total tonne-kilometres is despite the fact that food only makes up a fifth, by tonnes-lifted, of all UK goods,⁵² a disparity which has several explanations.

First, food tends to travel further than any other type of good. Food's average length of haul, at 129km, is substantially further than the average

46 *UK Air Freight Study Report*, Department for Environment, Transport and the Regions, December 1998

47 Dawson J, Exel Logistics, personal communication October 2002

48 *World Air Cargo Forecast, 2002-2003*, Boeing www.boeing.com/commercial/cargo/exec_summary.html

49 Wilmott K, *Understanding the Freight Business*, British International Freight Association, 2001

50 Whitelegg J and Williams N, *The Plane Truth: aviation and the environment*, Transport 2000 and Ashden Trust, London, 2001

51 Defined according to the DETR's commodity groups in *Transport of Goods by Road in Great Britain 2001*, DTLR, 2001. There are three sub-groups: agricultural products (bulk cereals, potatoes, other fresh and frozen fruit and vegetables, sugar, live animals and animal foods); beverages (alcoholic and non-alcoholic except tea, coffee and milk); other foodstuffs (meat, fish, dairy products, fruit, cereals, other foods including tea and coffee, tobacco)

52 *Transport of Goods by Road in Great Britain, 2001*, DTLR, 2001

53 *Freight Transport by Road: goods moved by vehicles over 3.5 tonnes 1991-2001*, Department for Transport, www.dft.gov.uk/stellent/groups/dft_control/documents/contentservertemplate/dft_index.hcst?n=7001&l=3

of 94km. A fifth of food (by weight) moves more than 200km.⁵⁴

Second, as one European Commission (EC) report points out⁵⁵ the distance goods travel is partly because the supply chain has become more complex. Not only are we sourcing from further afield, but we also move goods about more for various kinds of processing. This has led to the creation of more transport stages or links in the supply chain, otherwise known as an increase in the 'handling factor.' Indeed in the ten years between 1985 and 1995 there has been an 18% increase in this handling factor for freight of all kinds. The report does not provide a sectoral breakdown but, given the growth in processed foods, it is likely that this trend applies to the food sector too and has contributed to the increase in food-related tonne-kilometres.

Some food is still moved by rail, but not much. Rail accounts for around 6% of freight moved in the UK, expressed in tonne-kilometres.⁵⁶ Reliable data for food movements by this mode are no longer available – following the privatisation of

the rail industry, such information is no longer held publicly. However, one rail expert from the Institute of Transport Studies estimates that around 1–1.5 million tonnes are likely to move in

Freight in the UK: The general picture

Over 1.5 billion tonnes of goods move around the UK each year.⁶⁴ The logistics industry is a major employer, providing around 1.2 million jobs in transport, warehousing, handling and other activities⁶⁵ and accounting for around 4% of those in employment.⁶⁶

Road freight traffic grew by 67% between 1980 and 2001 (by 20% since 1991),⁶⁴ broadly in line with economic growth, although recent years have seen the economy becoming slightly less transport intensive. Over the same period the average length of haul has increased by around 40%.⁶⁴

There are also light goods vehicles (LGVs) to consider. The total size of the LGV fleet in Britain is already about five times that of heavy goods vehicles (HGVs) and is growing faster than both HGVs and cars. Vans also cover approximately 75% more vehicle-kilometres each year in Britain than the total HGV fleet.⁶⁷ Many of these vehicles will be owned by plumbers and electricians but many will be carrying goods. A breakdown by sector of the LGV fleet does not exist but a 1994 Department of Transport Survey⁶⁸ did find that LGVs accounted for 5.9% of total tonnes lifted and 4.6% of total tonne-kilometres on our roads, and that they were responsible for considerably higher rates of empty running than HGVs.

Most projections suggest that freight and light van traffic will grow faster than private car use, particularly if road pricing schemes become more widespread. One estimate predicts a 50% growth in commercial traffic by 2050, compared with 33% for cars.⁶⁹

At present HGVs account for 35% of emissions from all vehicles.⁷⁰ Government aims to reduce CO₂ emissions from freight by 0.7 million tonnes by 2010 relative to what the growth in emissions would have been had no measures to reduce their growth been put in place.⁷¹ Achieving the target would lead to an overall reduction in CO₂ but one that is less than the 0.7 million tonnes quoted.

54 *Transport of Goods by Road in Great Britain 2001*, DTLR, 2001

55 *Redefine: relationship between demand for freight transport and industrial effects*, final report. Contract No. RO-97-SC.1091, European Commission, Brussels, February, 1999

56 *Domestic Freight Transport by Mode 1991-2001*, Department for Transport, www.dft.gov.uk/stellent/groups/dft_transstats/documents/page/dft_transstats_506359.xls

57 Fowkes T, Senior Lecturer, Institute for Transport Studies, University of Leeds, personal communication, August 2003

58 *Travel to the Shops in GB*, Personal Travel Factsheet 6, Department for Transport, 2003

59 Figures supplied on request from Department for Transport. Source: *National Travel Survey*, 1999/2001

60 *Continuing Survey of Road Goods Transport*, DTLR, 2001

61 *Waste not Want Not: a strategy for tackling the waste problem in England*, Strategy Unit, London, 2002

62 *Towards Greener Households: products, packaging and energy*, INCPEN, London, 2001

63 *The Environment in your Pocket 2002*, DEFRA, London, 2002

64 *Transport of Goods by Road in Great Britain 2001*, DTLR, 2001. Note: figures apply to goods carried in vehicles weighing over 3.5 tonnes

65 *Solving the Skills Shortage*, Freight Transport Association, Tunbridge Wells, October 2001

this way, accounting for approximately 0.3 billion tonne-kilometres⁵⁷ – equivalent to around 0.75% of road movements. He bases this figure on a review of historical data.

Of course the journey does not end once the food reaches the store – the food needs to be taken home. All the signs are that people are now travelling further to shop. Shopping accounts for a fifth of all personal trips (216 trips a year) 55% of which are food-related.⁵⁸ Of the average 893 miles an individual travels for shopping, over a third (349 miles) are for food. The majority of these trips (60%) are by car. Food shopping accounts for 5% of all car mileage, an increase from 2% in 1996/98.⁵⁹ We discuss the contribution these trips make to the UK's CO₂ emissions in section six.

Finally, after the food has been eaten, there is the waste to consider. In 2001, 31 million tonnes of household waste were removed for disposal, accounting for 720 million tonne-kilometres.⁶⁰ Nearly 17%⁶¹ of this was kitchen waste – in other words, food. Packaging makes up around a quarter⁶² of household waste. Nearly 70% of this is food-related⁶² – working out as 17.5% of household waste. In total, then, 34.5% of household waste is associated with the food supply chain. Although domestic waste contributes only 7%⁶³ to the overall waste stream its relatively high organic content means that it has a particularly significant impact on climate. Decomposing organic matter produces methane, a far more potent greenhouse gas than CO₂. One should of course note that waste occurs at all stages in the food supply chain. Agriculture alone accounts for 20% of all waste generated in the UK⁶³ although much of this will be organic matter which is simply applied to the fields. Figures for the tonne-kilometres generated during the course of removing and disposing of food waste from processing plants are, unfortunately, not available.

2.5 Food transport: The social and environmental impacts

The impact of our food transport system upon society and the environment is a function of the overall distances involved, the mode of transport chosen, the route the vehicle takes, the fuel the

vehicle uses and the way the vehicle is maintained, managed, loaded and driven.

Of all transport's impacts, perhaps the most significant is the CO₂ emissions it generates. Worldwide, transport (both freight and passenger travel) accounts for nearly a quarter (23.8%) of total human-generated CO₂ emissions.⁷² Freight transport is responsible for a considerable share of this: one estimate puts it at 43.4%⁷³ of total transport energy while another sets it at an even higher 55%.⁷⁴ From averaging these estimates, one can roughly calculate⁷⁵ that freight movements account for over a tenth of world CO₂ emissions. In the UK, freight transport's contribution amounts to around 8.4% of the country's CO₂ emissions.⁷⁶ Both these figures are for freight movements in general, not just those related to food.

In addition to CO₂ emissions, goods movements create other serious social and environmental problems. The major concerns associated with each of the four main modes of transport, road, sea, rail and air are summarised next.

66 Office of National Statistics, Census 2001

67 *Transport Statistics Great Britain 2002*, Department for Transport, 2002

68 Department of Transport 1994, cited in: Browne M, Allen J, Anderson S and Wigan M, *The Growing Importance of Light Goods Vehicles in the UK*, paper presented at the Logistics Research Network annual conference 2002, published by the Institute of Logistics and Transport, Corby, Northants, 2002

69 Eyre N, Fergusson M and Mills R, *Fuelling Road Transport: implications for energy policy*, Institute for European Environmental Policy and Energy Saving Trust, London, 2002

70 *Focus on Freight*, Department for Transport, June 2003

71 *Transport Ten Year Plan: background analysis*, Department for Transport, London, 2000

72 *CO₂ Emissions from Fuel Combustion*, International Energy Agency, Paris 2001 (1999 data) <http://climate.volpe.dot.gov/present/oecd0101.pdf>

73 *Global Transport and Energy Development: the scope for change*, Annex 2.4, World Energy Outlook (1995 figures), www.worldenergy.org/wec-geis/publications/reports/etwan/supporting_publications/annex_2_chap4_transport.asp

74 Simms A, *Collision Course: free trade's ride on the global climate*, New Economics Foundation, London, 2000

75 The relationship between energy use and CO₂ emissions is not an exact one but the calculation gives an indication of the figures involved

76 See section six for details of the calculations

Climate change: The likely impacts

Climate change, accelerated by emissions of CO₂ and other greenhouse gases, is arguably the most pressing environmental concern we face today.⁷⁷ The Intergovernmental Panel on Climate Change (IPCC) warns that we need to cut greenhouse gas emissions from human activities by 60–80% by 2050 in order to avoid the worst impacts of climate change.⁷⁸ If we are to achieve this goal, all sectors of industry and society will have to play their part.

Global temperatures have risen by around 0.6 °C over the last century. Meteorologists are cautious of making a direct link to the heat-waves and severe floods which have affected Europe with increasing frequency over the last few years. They do, however, point out that these events are consistent with climate change model predictions. Future years are likely to bring higher temperatures, rising sea levels and coastal flooding, extreme weather events including flooding, storms, forest fires, die-back of tropical rainforests, desertification, loss of farmland, species loss, and the spread of tropical diseases such as malaria to areas not previously affected.⁷⁹

There is also the possibility that beyond a certain critical point we will see a 'runaway' effect of spiralling forest die-back, leading to more CO₂ emissions, higher temperatures causing more forest die-back and so on, with potentially disastrous prospects both for the human race and for many other forms of life.

Furthermore, new research suggests that previous estimates of the growth in temperature are too low. Scientists are now warning that the smoke and aerosol particles (another industrial legacy) which we have also been emitting into the atmosphere have had a cooling effect, slowing down previous rates of temperature rise. And while this effect was known before, new research suggests that this cooling influence may be much greater than previously estimated. As we cut down on these other emissions (for good social and environmental reasons), the effect disappears and we are left to face, unprotected, the full effects of climate change. Some estimates now put the possible rise in temperature as high as 7–10° C by the end of the century.⁸⁰

While the most catastrophic impacts of climate change are likely to be – as so often – felt by the poorest countries, we in the UK will not escape the effects.

As regards the more direct impacts on human health, a report by the Department of Health⁸¹ points out that while cold-related winter deaths are likely to decline we will see more cases of heat and ozone related deaths, food poisoning, vector-borne⁸² and water-borne diseases. The risk of major casualties occurring as a result of severe gales, coastal flooding and other extreme weather events will increase substantially.

77 'Concerted international effort' necessary to prevent climate change, speech by Tony Blair at event organised by the Sustainable Development Commission, London, 24 February 2003

78 *First Assessment Report*, Intergovernmental Panel on Climate Change, Geneva, 1990

79 *Climate Change: the UK programme*, DETR, November 2000

80 *New Scientist*, 4 June 2003, www.newscientist.com/news/news.jsp?id=ns99993798

81 *The Health Effects of Climate Change*, Department of Health, 2001

82 Such as malaria

83 *Redefine: relationship between demand for freight transport and industrial effects*, final report, Contract No. RO-97-SC.1091, European Commission, Brussels, February 1999

84 Emissions for agricultural products are lower than in France, which can be explained by the fact that the agricultural sector is less important to the UK economy than to France

Road

Figures in one European Commission (EC) report⁸³ suggest that the UK generates considerably higher levels of CO₂ emissions in the course of transporting foodstuffs than any of the other sample European countries.⁸⁴ Tables 1 and 2 illustrate this.

Although at the raw commodities level, the UK performs better than France and only marginally worse than the Netherlands, its CO₂ count is much worse later on in the food chain. The reasons for this will be various but an important factor is the high proportion of processed food, involving longer and more elaborate distribution processes, which the UK consumes relative to other European countries. Section six shows calculations of food transport's contribution to total UK CO₂ emissions.

Table 1 Total transport emissions CO₂ and NO_x in 1000 tonnes

REDEFINE group	Year	France	Netherlands	United Kingdom
CO₂ emissions		<i>1000 tonnes</i>		
Agricultural products	1995	1247	991	1057
	2005	1505	1275	1100
Beverages and other foodstuffs	1995	1416	856	2489
	2005	1482	812	2904
NO_x emissions		<i>1000 tonnes</i>		
Agricultural products	1995	18.1	14.5	15.4
	2005	10.9	9.4	8.2
Beverages and other foodstuffs	1995	20.4	12.4	35.9

Table 2 CO₂ per million population⁸⁵

	2001	<i>Agricultural products</i>		<i>Beverages/other food</i>	
	Population	CO ₂ 1995	CO ₂ per 1m pop	CO ₂ 1995	CO ₂ per 1m pop
UK	58.8	1057	17.98	2489	42.33
France	59.2	1247	21.21	1416	24.08
Netherlands	16.0	991	16.85	856	14.56

Other forms of air pollution have a more noticeable and immediate impact on our health and the environment than the longer-term climatic effect of greenhouse gases. Although improvements in vehicle technology mean that lorries produce far fewer air pollutants than they

did ten years ago, road transport, including freight, is a significant emitter of air pollutants.

Road traffic also accounts for 56% of black smoke, to which lorries make a substantial contribution, although specific data was not available.

Table 3 The contribution of HGVs to air pollutants, 2001

Pollutant	HGV share of road transport emissions %	HGV share of emissions from all sources %
Nitrogen oxide (NO _x)	48.8	20.9
Particulates (PM ₁₀)	5.7	35.6
Volatile organic compounds (VOCs)	2.2	14.1

Source: National Atmospheric Emissions Inventory (2001 data).

The health consequences are severe. It is estimated that around 24,000 deaths may be hastened each year in the UK by periods of high air pollution, and a further 24,000 hospital admissions may also be triggered.⁸⁶ To this can be added an unspecified number of people suffering from chronic pollution-related ill health. Particulate emissions (mostly produced by lorries) have also been linked with the development of

⁸⁵ Figures supplied by Professor Alan McKinnon, Heriot-Watt University, personal communication, Edinburgh, May 2003

⁸⁶ *Quantification of the Effects of Air Pollution on Health in the UK*, Committee on the Medical Effects of Air Pollutants, Department of Health, London, 1998

cancer as well as with respiratory and cardiovascular diseases.⁸⁷

Road deaths are the most forceful reminder of the damage road transport can cause. In 2002, of the 3431 deaths and 35,976 serious injuries on Britain's roads,⁸⁸ lorries were involved in 532 and 2374 of these respectively; for LGVs the figures were 311 fatalities and 2585 serious injuries.⁸⁹ Although there is a smaller chance of being involved in an accident with a lorry than with another vehicle, the chance of dying if this does happen is about twice as high. Put another way, although HGVs account for 6% of all vehicle mileage, they are involved in 15% of road deaths.⁸⁹

A range of other, less quantifiable impacts are also associated with road transport, and freight distribution is implicated in these. While less easy to measure, they nevertheless have damaging effects upon the lives of many people. These include noise and a decline in the quality of community life and the street environment.

87 *Particles – PM10 factsheet*, National Society for Clean Air, www.nasca.org.uk/

88 *Road Casualties Great Britain: main results, 2002 data*, Department for Transport, 2002, www.dft.gov.uk/stellent/groups/dft_transstats/documents/page/dft_transstats_022247.hcsp

89 Supplied by Department for Transport, 2002 data

90 *GHG Emissions for International Shipping and Aviation*, study commissioned by the Swedish Environmental Protection Agency, ECON Centre for Economic Analysis, Norway, January 2003, www.environmentdaily.com/docs/swedeeepa3.pdf

91 *A European Strategy to Reduce Atmospheric Emissions from Seagoing Ships*, Communication from the EC to the European Parliament and the Council, Brussels, November 2002

92 The following are classed as contaminants: sewage, persistent organic pollutants, heavy metals, oils, nutrients, sediment mobilisation and litter

93 GESAMP, *The State of the Marine Environment*. IMO/FAO/UNESCO/ WMO/IAEA/UNEP/ UN Joint Group of Experts on the Scientific Aspects of Marine Pollution. UNEP Regional Seas Reports and Studies 115, UNEP, Nairobi, 1990. Note: More recent figures are not available

94 International Maritime Organisation, <http://imo.org/Environment>

95 Capaldo K, Kasibhatla P, Fischbeck P, and Pandis S N, Effects of Ship Emissions on Sulphur Cycling and Radiative Climate Forcing over the Ocean, *Nature*, 10 August 1999, Macmillan, London

96 Huggett D, *Ten years of developing ports policy in the UK*, RSPB, London, February 2003

Sea

Shipping accounts for 2% of annual global CO₂ emissions.^{90,91} Bunker fuel used for shipping is not subject to fuel duty, and while the CO₂ emissions are relatively small, shipping's environmental performance is extremely poor in other respects. Marine transport accounts for around 12% of contaminants⁹² entering the world's oceans⁹³ causing damage to the marine ecosystem. It also produces 7% of global nitrogen oxide emissions. These emissions cause acid rain and human health problems.⁹⁴

In addition, shipping produces large quantities of sulphur dioxide (SO₂) emissions. The EU predicts that if nothing is done to reduce them (and a proposal putting policy measures in place is now undergoing consultation in Member States) by 2010, shipping will produce emissions equivalent to 75% of all EU land-based SO₂.⁹¹ This will mean that by 2010 shipping could be responsible for around 40% of EU-generated sulphur emissions. Sulphur emissions are not only responsible for acid rain but can also cause respiratory problems and heart attacks.

The problem of emissions on specific routes has been acknowledged by the International Maritime Organisation.⁹⁴ Moreover, there is increasing evidence to suggest a link between sulphur emissions and the greenhouse effect. Research reported in *Nature* magazine⁹⁵ suggests that marine emissions trigger the creation of localised clouds (particles from exhausts act as nuclei around which water vapour condenses) which in turn lead to radiative forcing (see glossary), and hence a greenhouse effect.

For many foods, refrigerated storage during the journey will also have produced considerable quantities of greenhouse gases. Refrigeration units in transit tend to be less energy efficient than stationary ones.

It must also be remembered that lorry journeys will still be involved at either end of the journey and as such shipping is implicated both in the growth in road transport, and in the road infrastructure that serves it. The ports that serve the freight industry come with significant environmental downsides of their own. These include the loss of coastal land, the dredging of channel waters, noise, and the loss of wildlife.⁹⁶

Rail

Rail transport⁹⁷ accounts for just 1% of the UK's CO₂ emissions, in comparison with the 24% generated by road transport.⁹⁸ While not as energy efficient as shipping, recent years have seen the rail freight industry investing in cleaner engines, such as Class 66 locomotives. As with shipping, road transport will still be needed at both ends of the journey and there will also be land use and community impacts at the site of rail freight terminals and sidings.

Air

The rapid growth in air freight has already been highlighted. The environmental consequences of this are very serious. In addition to CO₂ (around 2% of all human-generated sources),⁹⁹ aviation produces oxides of nitrogen, which lead to the formation of ozone, particulates and water vapours, the latter creating the familiar contrails we see on a clear day. This vapour has an additional greenhouse effect by trapping heat within the atmosphere. Once these effects are included, estimates put the contribution of the aviation industry to human-generated climate change at a higher 3.5%.¹⁰⁰ However this still does not include the warming effect of the extra cirrus cloud which is formed from aviation-derived soot and sulphates. While this effect has not yet been quantified, experts believe it could be much more significant than the warming effect of contrails. If so, then aviation's contribution to climate change could be considerably higher than present estimates suggest.⁹⁹

As it stands, forecasts suggest that by 2050 aviation is likely to be a major contributor to climate change, accounting for as much as 15% of greenhouse gas emissions.¹⁰¹ The majority of those emissions will, as now, result from

passenger movements but it should be noted (see *Air freight: growth in all sectors*) that the growth in air freight is even more rapid than that of passengers.

2.6 Conclusion

The transport of food by air, sea and land is responsible for significant quantities of greenhouse gas emissions. In addition, such transport creates a number of other social and environmental problems, including air, land and sea pollution, human health problems, road injuries and deaths, land-take and consequent loss of biodiversity, and a less quantifiable but nevertheless important decline in the quality of life for many people.

Section four looks at why the growth in food transport has come about. First, however, the following section examines what is being done to improve the environmental performance of the freight industry.

97 Of all kinds: a breakdown by freight and passenger trains is not available

98 *Transport Statistics Great Britain*, 2002 edition, Department for Transport, 2002. Note: this figure includes the source category (ie for trains running on electricity this would include the CO₂ emitted during the process of producing the electricity. Most freight trains in any case run on diesel, but the source category is also included here, as it is for road transport

99 Whitelegg J and Williams N, *The Plane Truth: aviation and the environment*, Transport 2000 Trust and Ashden Trust, London, 2001

100 IPCC Special Report, *Aviation and the Global Environment*, Intergovernmental Panel on Climate Change, Geneva, 1999

101 *Aviation and the Global Atmosphere*, Intergovernmental Panel on Climate Change, Cambridge University Press, 1999

Section three

The technological approach: How far will efficiency get you?

Government policy places great emphasis on improving efficiency and achieving modal shift as ways of achieving sustainable distribution systems.¹⁰² This section briefly explores the extent to which gains in these areas can help reduce emissions from food transport.

The discussion begins by considering how better fleet management can reduce emissions; it goes on to look at the role information technologies can play in cutting unnecessary travel; at the scope for modal shift to rail; and at the case for alternative fuels. It then assesses how far we can and should rely upon technological solutions to reduce transport's contribution to climate change.

3.1 Fleet management

The energy efficiency of a vehicle will depend both on its design (including the type of fuel it runs on, and its weight relative to that of the

contents being carried), and on the way it is operated; in other words, how the driver drives it, the route it takes and how the manager runs and maintains the fleet. Research conducted at the University of Huddersfield¹⁰³ concludes that the most successful interventions, in order of effectiveness, are:

- Driver training / driver's fuel efficiency skills.
- Vehicle specification / choosing the right vehicle manufacturer.
- Transport efficiency management / routeing and scheduling.
- Design features aimed at improving the vehicle's aerodynamicity.
- Loading factors, empty running and payload weights.

Training for drivers

Training drivers to drive in ways that reduce fuel consumption can achieve significant results. Fuel efficiency can vary by as much as 45% between different drivers using identical vehicles.¹⁰⁴ Training, aided by in-cab displays indicating, for example, the correct gear to use, can cut fuel consumption by about 10–15%.¹⁰⁵ Enabling drivers to see how much fuel they use also helps. A large scale trial of 'econometers' in the Netherlands found that motorists could reduce fuel use by 15%. Predictably, results were better for private motorists than for employees who did not pay for the fuel.¹⁰⁶

As part of its sustainable distribution¹⁰² implementation strategy, the Department for Transport¹⁰⁷ has awarded funds for a £1.7 million driver training scheme. Drivers in the Department for Transport (DfT) pilot trial averaged 6% reductions in fuel use.

102 *Sustainable Distribution: a strategy*, Department for the Environment, Transport and the Regions, London, 1999

103 Coyle M, *Fuel Saving Interventions: facts and fictions*, Transport and Logistics Research Unit, University of Huddersfield, 2002

104 Novern, Netherlands Agency for Energy and the Environment 1996, cited in *Fuel Efficiency Fleet Management: good practice guide* 218, DETR, London, 1998

105 Transport and Logistics Research Unit, *Reducing the Environmental Impact of Road Transport Operations: a review of inventions that can be applied by fleet operators*, presented at the CANTIQUE Workshop, Rome, 24th, 25th January 2000, University of Huddersfield, Huddersfield, 2000

106 *Econometer and Cruise Control: report of field trials*, Novern, cited in *Fuel Efficiency Fleet Management: good practice guide* 218, DETR, London, 1998

107 *£1.7 million for Lorry Driver Training*, news release, Department for Transport, London, 3 June 2003

Vehicle design

Using the right vehicle for the job can also make a difference. For instance, vehicles operating in hilly areas will need a different power-train specification from those operating in a flat part of the country. Similarly, the body for a vehicle transporting high density products will not need to be as large as one for low density products.¹⁰⁸ Recognising this, Marks & Spencer, in partnership with its logistics provider Joint Retail Logistics, has developed a vehicle for transporting clothing with scaled-down mechanicals, meaning that it is lighter than normal. The use of this vehicle has improved fuel efficiency by around 40%.

In addition, design features to improve aerodynamic performance can cut fuel use by about 16%.¹⁰⁹ Even apparently insignificant factors can have an effect – a white refrigerated trailer will be more energy efficient than a coloured one, as it reflects, rather than absorbs sunlight and heat.

Efficiency in the freight industry

The road haulage industry as a whole is doing little to improve its fleet efficiency. According to the Freight Transport Association there are over 65,000 road haulage operators in the UK, driving nearly half a million vehicles of 3.5 tonnes and over.

Notwithstanding the industry's vociferous complaints about the cost of fuel, a series of National Road Show Seminars in 2001 demonstrating how fuel can be saved barely attracted 200 delegates. And a study into the UK haulage industry showed that while 88% of fleets kept information on their fleet mileages, only 30% knew their total fuel expenditure and even fewer (20%) knew how much fuel their fleet consumed.¹¹⁰ Unsurprisingly, the larger operators are more likely than the smaller ones to have strategies in place to monitor, manage and improve fuel efficiency.

To improve efficiency throughout the industry, the Department for Transport runs initiatives such as the Road Haulage Modernisation Fund, and associated programmes including CleanUp and the Transport Energy Best Practice Programme.¹¹¹ A number of other bodies also provide information and advice.¹¹²

Load optimising

Another useful approach is to maximise the vehicle's load, so that the vehicle is carrying as much as possible. Combining light with heavy products, to ensure the vehicle is filled to the

maximum both by volume and by weight is one approach; double-deck trailers that make use of empty headroom space is another. Within the UK, the level of empty vehicle running in the food supply chain tends to be lower than in the freight industry as a whole – 22.7% for foodstuffs compared with 26.4% for the average across all sectors.¹¹³ One survey puts the figure even lower at 20%.¹¹⁴ This means vehicles are carrying loads 80% of the time. Moreover when they are carrying loads, the vehicles tend to be filled to around 70% of their deck-area,¹¹⁴ which is fairly good compared with the goods distribution industry as a whole.¹¹⁵

However on approximately a third of loaded journeys and a fifth of the total distance travelled (which includes the return journey) the vehicles were less than half full, when measured either by volume or weight. On average, around half the time vehicles were between 50%–90% full, which means that for the remaining time they were very underused indeed. One article concludes: *'There remains considerable potential for improving load factors on laden vehicles. This has been illustrated by two studies undertaken for ECR Europe, which revealed serious under-utilisation of space in trucks carrying grocery products.'*¹¹⁶

108 Coyle M, Whiteing A E and Murray W, *Fuel Saving Interventions: facts and fiction*, University of Huddersfield, Huddersfield, 2002

109 Transport and Logistics Research Unit, *Reducing the Environmental Impact of Road Transport Operations: a review of inventions that can be applied by fleet operators*, presented at the CANTIQUE Workshop, Rome, 24-25 January 2000, University of Huddersfield, Huddersfield, 2000

110 *Freight Industry Times*, Issue 4, McMillan-Scott plc, Manchester, Spring 2001

111 See: www.transportenergy.org.uk

112 See for example the University of Huddersfield's Transport and Logistics Research Unit www.hud.ac.uk/sas/trans/

113 *Transport of Goods by Road in Great Britain 2001*, Department for Transport, Local Government and the Regions (DTLR), London, 2001

114 McKinnon A and Leuchars D, *Vehicle Utilisation and Energy Efficiency in the Food Supply Chain*, Logistics Research Centre, Heriot-Watt University, Edinburgh, 2002

115 *Key Performance Indicators in the Food Supply Chain. Benchmarking Guide 78*, Department for Transport, London, April 2003

116 Braithwaite A and McKinnon A, *Retail Trends Affecting Sustainable Distribution*, in *Logistics and Transport Focus*, Institute of Logistics and Transport, Corby, Northants, April 2003

One of the article's authors, McKinnon, also notes inefficiencies in other areas. For around 15% of the vehicle's working time it is loaded and ready to go but not moving.¹¹⁵ With a temperature-controlled load, this represents a significant use of energy since mobile refrigeration units tend to be much less efficient than the warehouse-based units.¹¹⁵ These inefficiencies occur at all stages in the food chain, including from manufacturer to RDC and from RDC to store. There is also wide variation among retailers in their levels of efficiency.

3.2 Information and Communication Technology

Most of the multiple retailers now rely heavily on Information and Communication Technology (ICT) systems such as Paragon, Logiq, Manugistic, and Safeway's 'Integrated Transport System', which enable fleet managers to plan routes to minimise unnecessary or empty journeys, change plans as unexpected events arise, and communicate with drivers in their lorries. The control room, hearing of a road blockage, can then warn drivers and advise on an alternative route, so reducing the time and fuel the drivers waste sitting in a traffic jam. The fleet manager can also tell the driver to pick up an unplanned extra load on the way, eliminating the need to send out an extra vehicle. One of the ICT manufacturers (Paragon Software Systems) claims that the technology has enabled one fleet to cut out two vehicles in nine, and another to cut mileage by 20%.¹¹⁷ University of

Huddersfield research puts the savings from the installation of ICT systems at 25%.¹¹⁸

Section seven explores the potential contribution that ICT systems can make to achieving less carbon-intensive patterns of sourcing and distribution.

3.3 Modal shift

'Why don't they send more stuff by rail?' is a common refrain. In fact ASDA, Marks & Spencer and Safeway all use rail to transport some of their goods. Marks & Spencer receives at least two deliveries a week in this way, although security concerns over the use of the Channel Tunnel for freight are disrupting plans to build on this. The company also uses rail for daily deliveries to its distribution centre in Scotland. ASDA has made an entrance onto the rail freight scene, and now commissions six trains a week to carry goods (including food) from Daventry to Grangemouth. It has called its experience to date a 'massive success,'¹¹⁹ praising in particular its reliability, and there are plans to extend the use of rail to deliver from ports to distribution centres.

Safeway is the only retailer that uses rail daily to take goods from depot almost directly to the store.¹²⁰ It now wants to use the rail network to deliver into city centres at night. According to supply effectiveness controller Dave Timson, the aim is to 'deliver by train into stations like London's King's Cross overnight and have smaller vehicles collect the load. That would save us having to take lorries into cities, but first we need to persuade local authorities to relax curfews that ban out of hours deliveries to 40% of our stores.'¹²¹

However, for all these retailers the quantities are negligible compared with the amount they truck. Safeway, the leader in its support for rail freight, still only distributes a minimal amount by this mode. In 2002/3, rail made up 1.2% of total product-kilometres travelled and the target is to increase the share to 1.5% in 2003/4.¹²² This, in fairness, reflects less on their interest in rail and more on the financial, infrastructural and other difficulties associated with making the modal shift.

The prognosis for the future is somewhat uncertain. Government's progress report on its

117 Dennis R, *Why the Apathy to a Fuel Saving Culture?* in *Freight Industry Times*, issue 4, McMillan-Scott plc, Manchester, Spring 2001

118 Transport and Logistics Research Unit, *Reducing The Environmental Impact of Road Transport Operations: a review of inventions that can be applied by fleet operators*, presented at the CANTIQUÉ Workshop, Rome, 24-25 January 2000, University of Huddersfield, Huddersfield, 2000

119 ASDA plans increase in rail use to cut three million lorry miles, *Rail*, issue 468, EMAP, Peterborough, August 2003

120 The train delivers goods into Inverness and Georgemas Junction respectively, from where trailers are transferred to trucks for a final short journey to nearby stores

121 *The Grocer*, William Reed Publishing, West Sussex, 22 September 2002

122 CSR Report, Safeway 2003 www.safeway.co.uk

Ten Year Transport Plan acknowledges that many targets will probably not be met. The Strategic Rail Authority has suffered major funding cuts, resulting in reduced investment in rail freight – the consequence being that the promised 80% increase in the movement of goods by rail is highly unlikely to happen. Compounding this is a general feeling among logistics experts¹²³ that the rail industry's somewhat dated approach to doing business presents a major barrier to an increase in modal shift. Whether this impression is accurate or not, the consequence is a reluctance to shift to rail. In addition, there will always be a tension between the need to shift as many people off the roads and onto rail as possible, and the need to do the same for freight, while still planning in time for maintaining the rail network.

Nevertheless, given the right support and investment there is certainly potential for far more food and other goods to go by rail than is currently the case, particularly if greater co-ordination and co-operation were achieved with rail operators in mainland Europe. The European Commission has in fact proposed a new programme of EU subsidies designed to shift growth in freight transport away from roads and onto other modes.¹²⁴ The 'Marco Polo' scheme channels a modest €117m over a four-year period, towards the goal of removing 12 billion kilometres of freight per year away from roads and making it easier for businesses to bring goods in from Europe by rail.

Technological improvements have a role to play here. Longer and faster trains that enable more goods to travel without clogging up the track and slowing down passenger services will also help, as will more intelligent timetabling, signalling and scheduling. New wagon design, such as the SRA prize-winning mini-modal wagons, which enable smaller quantities of goods to be lifted on and off the track, also provide some of the flexibility that the food distribution industry needs.

3.4 Cleaner and alternative fuels

The development and application of lower and zero carbon fuel technologies remains the holy grail for the transport industry. Since October 2001, all new large goods vehicles must be fitted

with engines meeting Euro III standards, resulting in fewer local air pollutants. Unfortunately, they have also made engines less efficient (by up to 3%¹²⁵), thereby increasing the output of CO₂ relative to older Euro II engines.¹²⁶ At the moment, these technological and legislative constraints mean that there is a trade-off between the two environmental objectives. However, it is likely that this matter will be resolved over the next few years, with Euro V standards achieving cuts both in air pollutants and CO₂.

Compressed natural gas

Some retailers now use compressed natural gas (CNG), which produces far fewer local air pollutants. Vehicles running on gas are also much quieter, thereby bolstering retailers' arguments for lifting night-time delivery curfews. Companies converting to gas also avoid incurring the London congestion charge. Safeway has a fleet of 85 CNG vehicles – the largest fleet of its kind world-wide representing 11.5% of the Safeway fleet and 2.5% of its total HGV kilometres.¹²⁷ To service this it has three refuelling sites,¹²⁷ which are open to other bodies wishing to trial the use of CNG vehicles.¹²⁸ The 2003/4 target is to increase the number of CNG vehicles to 14% of the total fleet, accounting for 5% of total HGV kilometres.

However while CNG may be good from an air pollution perspective, it does not offer much at all by way of greenhouse gas savings, performing around 12% better than petrol-fuelled vehicles, and 2% better than diesel.¹²⁹

123 McKinnon A and Forster M, *Full Report of the Delphi 2005 Survey: European logistical and supply chain trends, 1999-2005*, Heriot-Watt University Logistics Research Centre, Edinburgh, July 2000

124 *EU Boosts Funds for Greener Freight Transport*, Ends Environment Daily, 7 February 2002, www.ends.co.uk

125 Coyle M, *Fuel Saving Interventions: facts and fictions*, Transport and Logistics Research Unit, University of Huddersfield, Huddersfield, 2002

126 *Safeway CSR Report*, 2002, www.safeway.co.uk

127 *Safeway CSR Report*, 2003, www.safeway.co.uk/cgi-bin/search.cgi?000012000007&location=000012

128 *The Grocer*, William Reed Publishing, West Sussex, UK, 16 November 2002

129 *Energy Saving Trust Welcomes Government Consultation on Road Fuel Gases*, news release, Energy Saving Trust, London, 18 June 2003 www.est.org.uk

Hydrogen fuel cells

The hydrogen fuel cell is sometimes hailed as the ultimate free-lunch, something-out-of-nothing solution to our energy and environmental problems. However, while fuel-cell technology could in the long term eliminate our dependence on fossil fuels, existing prototypes unfortunately do not. Hydrogen, the energy carrier, can be produced from a number of different sources and methods, provided, of course, that the source contains hydrogen. While it is possible to produce hydrogen from pure water or from another 'clean' renewable source, developing the infrastructure for this has proved difficult. At the moment a more feasible option is to produce it from hydrogen-rich fossil fuels. Thus, while a fuel-cell vehicle will produce no tail-pipe greenhouse gas emissions, once the production of hydrogen is taken into account the story is rather different. A number of studies have compared CO₂ emissions from a typical petrol vehicle with those from a fuel cell, based on various different systems.¹³⁰ These found that the CO₂ savings from a fuel-cell vehicle ranged between 25% and 80%. There are, then, still impacts, and substantial ones at that.

It is possible to power a fuel-cell vehicle using electrolytic hydrogen derived from renewable energy sources, but it has been argued that this may not be the best use of limited existing supplies.¹³¹ Turning renewable energy into electricity and then turning that into hydrogen for road transport is very inefficient, and, given its current limited practical availability, it may be better to use that renewable energy directly to reduce emissions elsewhere. As discussed in section seven, this might mean applying renewables technology more widely within the protected horticulture sector.

The use of biofuels

There are a number of other experiments underway which vary in size and importance. ASDA, for instance, is trialling biodiesel in its

logistics fleet.¹³² This mix of 95% diesel and 5% recovered vegetable oils achieves a 2.5% reduction in CO₂ emissions.

One study of low carbon transport options concludes that woody biomass (particularly willow) might offer the most hopeful source of future transport energy. This biomass could be used to produce methanol and ethanol or hydrogen, depending upon which technology proves to be most feasible. Indeed the study suggests that the UK could meet all its transport fuel needs through the cultivation of woody biomass on 25% of agricultural land, provided that road transport technology shifts to high-efficiency hybrid or fuel-cell vehicles, and provided too that we put policies in place that keep the growth in demand to the lower end of plausible projections.

Of course this raises questions as to what we use our land for, not least because there may be a trade-off between the twin goals of increasing self-sufficiency in our food and in our fuel supplies. It need not, of course, be a question of absolutes; it may be possible to achieve a balance between the two, based on a range of agricultural, geographical, economic and other factors.

Whatever the technology applied, it is likely that lorries will benefit less, and less rapidly from new developments than other vehicles. To quote the willow biomass report: *'Our modelling reflects the widely-held view that technical progress in heavy goods vehicles will be less rapid than elsewhere... as a result, fuel demand and carbon emissions from HGVs may well remain large and growing, and could do much to counteract the improvements which are possible in other vehicle classes.'*¹³¹

As a result, the efficiency of smaller delivery vehicles may well grow relative to heavy goods vehicles, although this is partly because smaller vehicles are starting from a lower base in terms of efficiency. However, even if the efficiency balance between large and small vehicles were to shift only modestly, this would nevertheless have implications for our sourcing and distribution systems.

Cleaner fuels for aircraft

A last word here goes to air freight. According to the Royal Commission for Environmental Pollution, operational improvements such as improving load factors, reducing delays at landing and allowing aircraft to fly on more direct routes

130 Pridmore A and Bristow A L, *The Role of Hydrogen in Powering Road Transport*, Tyndall Working Paper No.19, Tyndall Centre, Norwich, 2002

131 Eyre N, Fergusson M and Mills R, *Fuelling Road Transport: implications for energy policy*, Institute for European Environmental Policy and Energy Saving Trust, London, 2002

132 *The Grocer*, 16 November 2002, William Reed Publishing, West Sussex, UK, 2002

could reduce emissions by about 10%.¹³³ The commission, however, discounts the feasibility of using hydrogen for aviation for many decades, and certainly after it has been applied to surface vehicles. It endorses the aviation industry's own targets for reducing CO₂ emissions¹³³ per aircraft mile by between 10%–20% by 2008–2015,¹³³ but warns that efficiency alone will not be enough to curb the serious growth in greenhouse gas emissions from aircraft. Rolls Royce, a major manufacturer of aircraft engines for the world's airline industries is working to ACARE's¹³⁴ target of achieving a 50% reduction in CO₂ emissions by 2050. Nevertheless it points out that this will be an enormous challenge; as 'all the easy things have been done already.'¹³⁵ In addition, there is a trade-off between CO₂ reduction and an increase in other emissions which have a radiative forcing effect (see glossary).¹³⁵

However, according to Government's own air traffic growth projection figures, whatever greenhouse gas emission reductions are achieved in the air industry, they will in any case be cancelled out and superseded by the growth in demand from both passengers and freight.¹³³

3.5 Conclusion

The thoughtful and ingenious use of new transport technologies could help achieve enormous reductions in greenhouse gas emissions. Important savings are already being made, as this section highlights.

The fact remains, however, that whatever the gains in efficiency, more goods are being transported further and more frequently than ever before, leading to an absolute increase in tonne-kilometres. Despite the efficiencies achieved, existing technology still falls significantly short of mitigating this growth and delivering the 60–80% cuts in CO₂¹³⁶ that are needed by 2050.

It is also the case that technological improvement, while improving relative fuel efficiency, has at the same time contributed to an absolute growth in CO₂ emissions from transport. For a given amount of fuel, better transport technology has enabled us to move more goods than before, further and for the same price. As such the cost per product moved has been lowered, thus meeting both existing demand for these goods and enabling business to invest in developing new and different

products – products which consume energy in their production and distribution.

The growth in air-freighted foods provides an illustration. Where air-freighting produce might once have been simply an efficient use of spare space in the belly-hold of the aeroplane, this efficiency has spawned a new and environmentally highly damaging sector of the food industry. Although still relatively expensive, air-freighted foods are now a common sight in the average supermarket store. As our familiarity with such foods grows, so does demand, leading to the now standard use of dedicated freighters to deliver it. Soon, customers begin to regard such air-freighted products not as occasional luxuries, but as necessities, and in response the food industry builds a business strategy for expansion around it. A combination of greater supply and improved technological efficiency drives down costs and, true to classical economic theory, stimulates demand. The consequence is an ever more efficient air freight industry which nevertheless generates ever more greenhouse gas emissions.

Technology has both aided and driven growth since the beginning of society. The solution is most certainly not to go back to old technology or to stop innovating. In order to tackle the challenges of climate change we will need to use all the technological wizardry we possibly can. The options discussed in section seven place a very strong emphasis on technology. We suggest, however, that while technological improvement may be essential, it is not in itself sufficient. Technology is a tool, not a solution, a truism which is sometimes forgotten.

Section six asks whether or not measures to shorten the supply chain lead to a reduction in CO₂ emissions from transport and from the food life-cycle as a whole. The following section examines some of the social and economic influences that have helped lengthen them.

133 *The Environmental Effects of Civil Aircraft in Flight*, Royal Commission on Environmental Pollution, London, 2002

134 Advisory Council for Aerospace Research in Europe

135 *An Industry Perspective*, presentation given by Colin Beesley, Head of Environmental Strategy at Rolls Royce plc at *Sustainable Aviation: is the sky the limit?* conference organised by the Institute of Public Policy Research, London, 3 July 2003

136 *First Assessment Report*, Intergovernmental Panel on Climate Change, Geneva, 1990

Section four

Why things are the way they are: The influences shaping the food supply chain

The British food industry supplies the collective British stomach with over 40,000 different products, sourced from around the world, seven days a week, 24 hours a day. Reasonably enough, the industry rates its logistical infrastructure as the most efficient in the world.

However, with food-related greenhouse gas emissions continuing to rise, 'efficiency' has its limitations. The purpose of this section is to examine the forces which have shaped and which are continuing to shape the logistical status quo. This provides a context both for the life-cycle discussion in section six and for the carbon-reducing policy options outlined in section seven. The starting point is to understand why things are the way they are.

4.1 Shops

Most of us buy most of our food from supermarkets. The top four multiples (Tesco, Sainsbury's, ASDA and Safeway) together have nearly 50% (by value) of the food market.¹³⁷ In 2001 this represented half of £103.8 billion.¹³⁸

How has this come about? The following paragraphs trace the rise to power of the major multiples and the knock-on effects on smaller retailers, before examining the impact these changes have had on our eating habits, and on the sourcing and distribution of food.

¹³⁷ *Retailer Performance Index*, Institute of Grocery Distribution, Letchmore Heath, June 2001. www.igd.com/analysis/ Note: this is based on market share rather than till-roll data. More recent data using this method is not available

¹³⁸ *UK Grocery Retail Structure Update 2002*, *The Grocer*, William Reed Publishing, West Sussex, 2002

¹³⁹ *Major Events that have Shaped UK Grocery Retailing*, Factsheet, Institute of Grocery Distribution, Letchmore Heath, 2002. www.igd.com/default.asp

Supermarket history

The first self-service supermarket opened in the 1950s,¹³⁹ soon after the end of war-time rationing. A few years later, in 1960, the Common Agricultural Policy (CAP) was founded and the next few years saw a massive growth in farm yields. The national motorway-building bonanza of the ensuing decade, and a growing public enthusiasm for imported foods acquired on increasingly affordable holidays abroad, set the pattern for a food retail system founded on cheap transport, cheap farm-gate prices and a highly receptive, convenience-enamoured public.

The supermarkets' popularity and power continued to grow in the 1970s and 1980s as they extended their range beyond packaged offerings, opened new and larger stores and took advantage of their increasing influence to bypass the wholesale sector completely, instead doing business directly with the manufacturers. This allowed them to cut prices further still. In addition, the supermarkets began to sell very competitively priced own-brand product ranges, adding to their now considerable appeal. To streamline the highly complex ordering and delivery process the supermarkets began to purchase centrally and invested in a network of regional and national distribution centres to which supplies were delivered. We describe this system in more detail below.

On the wider economic front, the 1980s was a period of huge growth in international trade. Cheaper products from the developing world and – for the red meat sector – the damaging impact of BSE, further reduced the competitiveness of British farming, and meant that the shelves of supermarkets and independents alike were stocked with more imports than ever before.

Concurrent with the supermarkets' stellar growth this period saw a major decline in local

independent stores, a decline that continued into the 1990s (see box below: *The decline of the small players*).

The decline of the small players

One study estimates that during the period 1994 to 1999, there was a 17% fall in independent and co-operative stores.¹⁴⁰ More recent research shows that there were 953 fewer convenience stores in the UK in 2001 than in 2000, and that another 3700 shops were set to close in the five years after that.¹⁴¹

There has also been a decline in small food manufacturing businesses. Between 1997 and 2002, for instance, the number of food manufacturing enterprises registered for VAT fell by 11.9%.¹⁴²

Supermarkets have been implicated in this decline. Critics have accused them of exerting undue control over the supply chain and forcing many smaller players to operate on the smallest of margins.¹⁴³ An investigation by the Competition Commission in 2000¹⁴⁴ concurred with this judgement and, to remedy the situation, recommended the setting up of a Code of Practice for major retailers. However many suppliers do not feel that the code has improved the situation¹⁴⁵ and as a result the food manufacturing sector continues to be dominated by a handful of big players, while the 5000 or so manufacturers who account for 80% of our total food and drink businesses take only 10% of the sector's turnover.¹⁴⁶

The introduction of planning restrictions in the 1990s, a move aimed at curbing shopping-related car trips and which, logically, should have favoured smaller, independent retailers situated in urban areas, did not halt the decline. Food-related car trips kept increasing¹⁴⁷ while the supermarkets simply expanded their existing stores – a trend that continues today. Despite planning restrictions, the trend is still towards ever larger store formats, with the leading retailers now operating 5413 spaces of 25,000 square feet or more.¹⁴⁸

In addition, the supermarkets began to invest more heavily in city-centre locations by developing smaller 'Local' and 'Metro' style formats. These cater to the everyday top-up and on-the-way-home-from-work shopper, a market where the independents have hitherto had an advantage. This approach has proved very successful and Tesco is on course to open 1000

more Express stores over the next five years,¹⁴⁹ in addition to the 100 or so that it currently operates.¹⁵⁰

The supermarkets are also gaining strength and influence in other areas, such as home deliveries. Once again, Tesco is the leader here, reporting sales of £447 million in its 2003 Annual Review¹⁵⁰ delivering to 110,000 homes a week and logistically capable of serving 96% of the population. The multiples have also moved into non-food retailing, ASDA's clothing range, 'George', being a particularly successful example. In addition, they are exploring new business areas such as finance.

More products, more choice, longer supply chains

The supermarkets' successful dominance of the grocery market has, however, helped lengthen the supply chain. The reasons are complex and various, perhaps the most obvious being the supermarkets' ability to satisfy the every whim of our increasingly well-travelled tastebuds. We are

140 Study by A C Nielsen, cited in *Ghost Town Britain: the threat from economic globalisation to livelihoods, liberty and local economic freedom*, New Economics Foundation, London, 2002

141 Institute of Grocery Distribution figures, cited in *Ghost Town Britain: the threat from economic globalisation to livelihoods, liberty and local economic freedom*, New Economics Foundation, London, 2002

142 *The Food Industry*, special report, *The Grocer*, William Reed Publishing, West Sussex, October 2002, <http://grocertoday.co.uk/resources/marketreport.asp?r=410>

143 See virtually any issue of *The Grocer* trade magazine, William Reed Publishing, West Sussex

144 *Supermarkets: a report on the supply of groceries from multiple stores in the United Kingdom*, Competition Commission, London, 2000

145 *Suppliers Plan Appeal Over Code to Sir Don*, *The Grocer*, William Reed Publishing, West Sussex, 5 October 2002

146 *Small Food Producers in the UK*, Factsheet, Institute of Grocery Distribution, Letchmore Heath, 2002, www.igd.com/default.asp

147 Data supplied by Giselle Hillman, Department for Transport, from the National Travel Survey 1999/2001

148 *UK Grocery Retail Structure Update 2002*, *The Grocer*, William Reed Publishing, 2002

149 *In the Express Lane*, *The Grocer*, William Reed Publishing, West Sussex, July 6 2002

150 *Tesco Annual Review*, 2003 http://81.201.142.254/presentResults/results2002_03/Prelims/Report/site/uk_overview.htm#storedev

no longer surprised to see strawberries on the shelves in December and indeed have come to expect them to be available. The consequence has been the development of international supply chains designed to provide us with these foods.

Giving people what they want is the mark of any thriving business. Many independent retailers do just the same; an ethnic store will sell yams and callaloo to its local Caribbean customers, an organic retailer will offer wheat-grass juice to health-conscious Bayswater residents. Supermarkets differ only in the scale and range of their offerings, in the size of their customer base and in the sophistication of their supply chain operations.

However it is also the case that by anticipating what we might want if it were marketed to us appropriately – anything from Cheestrings to pre-prepared Caesar salads – supermarkets, together with manufacturers, have also very effectively created demand, and they continue to do so. Most of us do not actively need many of the goods on offer, but once we see them in store, we try them, buy them and a need is created. Their efficient management of supply chains across the world and hence their ability to provide almost anything, always, anywhere, means that supermarkets and major manufacturers combined, have created consumer expectations of consistency and availability which they are now bound not just to fulfil but also (if they want to remain competitive) exceed. The consequence again, is more transport.

Demand creation is as old as commerce. However the pace of it is greater now than ever before. Due to their size and influence, supermarkets are able to offer us new products on a regular basis. Manufacturers, for their part, can gain access to consumers nationwide via the supermarkets' comprehensive distribution network. New products, if successful, can be quickly rolled out nationally¹⁵¹ and rapidly generate profits. This synergy between manufacturers and supermarkets has helped drive the rapid growth

in the grocery industry, as the box below highlights. However, since each of these new products will involve often highly complex, and lengthy supply chains, and will for the most part need to be distributed to all the retailer's stores across the country, the consequence is inevitably more transport.

The multiples and the major manufacturers: A successful partnership

Some of the most well-known food manufacturing brands have been around for over 100 years. Brands originally developed as a means of guaranteeing to the customer that a product, such as soap or sugar, was consistent in quality; that it was not adulterated and would be the same tomorrow as it was today.¹⁵² However, the meaning of brands has now grown beyond these original qualities; the brands a person chooses have now become a way of defining that person's identity.¹⁵²

Reliability, uniformity and predictability are core to the supermarkets' brand identity. The best way of ensuring consistency is for a retailer not only to build up and centralise the sourcing and manufacture of its own-brand products (often made by large manufacturing companies that also make branded foods) but also to buy from global manufacturers such as Unilever and Nestlé. Sometimes the relationship between retailer and manufacturer is deliberately emphasised, one example being the marketing tie-in between Tesco and Hovis, whose flour is used to make in-store bread.¹⁵³

For the supermarkets, this partnership represents a risk-reducing approach. The retailers are never more than a tampered bottle lid away from a major food scare and subsequent commercial armageddon. Doing business with the big players, who have more formal processes in place to ensure quality control, is logistically easier than checking the quality control procedures of a myriad of small businesses. It also enables retailers more readily to meet legal Due Diligence requirements (see glossary) and hence fortify themselves against charges of liability should something go wrong. This, in turn, is true of big manufacturers buying raw materials from their suppliers; working with larger suppliers is simpler. Big brands are also popular with customers who like the reassurance that a well-known name is perceived to offer.

¹⁵¹ Obviously this trend can be taken too far and many manufacturers, including Unilever, are now slimming down their product ranges

¹⁵² Lury G, *Adwatching*, Blackhall Publishing, Dublin, 2001

¹⁵³ *Hovis Links with Tesco, The Grocer*, William Reed Publishing, West Sussex, 28 June 2003

Future trends

The signs are that future years will see further concentration within the retail sector as well as expansion by British multiples into overseas markets. Tesco, the UK's market leader, is also the world's seventh largest retailer by turnover (behind Walmart at number one)¹⁵⁴ and is particularly strong in Thailand and Eastern Europe. This general UK trend towards concentration reflects in miniature the global picture. The Institute of Grocery Distribution (IGD) forecasts that the top ten European retailers will increase their combined global share from 22.7% to 36.8% between 2000 and 2010.¹⁵⁵ The global food retail market will grow 21.8% from 2001 to 2006 to reach \$3543 billion. Much of this growth will come from expansion into Asian Pacific markets.¹⁵⁶

However this prognosis requires some qualification. It may be that future years will see supermarket power challenged, largely by the restaurant and take-away sectors, as more and more of us choose not to cook at all. There are also slight but nevertheless discernable signs that some consumers would like a return to locally focused or alternative systems of sourcing and distributing foods. One industry analysis highlights the fact that *'Although food retailing continues to be dominated by the big four supermarket chains, the long term decline in sales through specialist food outlets was halted in 2001. Greengrocers, in particular, showed healthy sales growth.'*¹⁵⁷

How far this trend is likely to become more mainstream is discussed further in section five.

4.2 Shoppers

There have been huge demographic changes in our population over the last thirty years. These have had, and continue to have, a major impact on the way we eat.¹⁵⁸

The way we live

For a start, we are becoming more solitary. Nearly a third of us (29%) lives alone, twice the number compared with 1961. Nearly two thirds (61%) of homes are childless. Those of us who do have children are having fewer of them; the

proportion of families with three or more children declined from 41% in 1972 to 26% in 1998/9.

The average population make-up is now older than it has ever been. Just over a fifth (21%) of us are under sixteen and this figure is expected to fall to 18% by 2021. By 2008 there will probably be more pension-aged people than children.¹⁵⁹

We are also, on average, richer than past generations. Disposable income doubled between 1972 and 1998 although income disparities grew too.¹⁵⁸ This wealthier, older generation is extremely busy. We now work, on average, the longest hours in Europe.¹⁵⁹ Women make up nearly half the workforce and account for more than a third of full-time employees.¹⁶⁰ They have far less time to cook and prepare meals for the family than before even though they may still, on the whole, be responsible for food provision within the family.

Cultural expectations

We may be working hard but we are also taking more holidays than ever before, often taking advantage of cheap flights to travel abroad, where many of us acquire a taste for the local food. Almost half of us (49%)¹⁶¹ flew in 2001, mainly outside the UK and for holiday. The British population is also more ethnically diverse than it has ever been. Nine per cent of the English (as opposed to British) population is of mixed or

154 *Global Retail Index: Factsheet*, Institute of Grocery Distribution, Letchmore Heath, February 2003, www.igd.com/default.asp

155 *European Grocery Retailing 2002*, Institute of Grocery Distribution, Letchmore Heath, 2002

156 *Global Retailing 2003*, Institute of Grocery Distribution, Letchmore Heath, 2003

157 *The Food Industry*, special report, *The Grocer*, William Reed Publishing, West Sussex, October 2002 <http://grocertoday.co.uk/resources/marketreport.asp?r=410>

158 *Food Consumption 2000: the one-stop guide to the food consumer*, IGD Business Publications, Institute of Grocery Distribution, Letchmore Heath, August 2000

159 *UK Staff Work Longest Hours in Europe*, says TUC, Ananova Ltd, 27 August 2001

160 *Labour Market Statistics*, August 2003, Office of National Statistics www.statistics.gov.uk/pdfdir/lmsuk0803.pdf

161 *Attitudes to Air Travel*, Department for Transport, 2001, www.dft.gov.uk/stellent/groups/dft_transstats/documents/pdf/dft_transstats_pdf_505963.pdf

non-British ethnic origin, with this rising to 29% in Greater London.¹⁶²

In other words, we are now more independent in our living arrangements, wealthier, busier, older, and either from, or acquainted with, a variety of different cultures.

These changes have had a drastic effect on the way we eat and on the supply chains that deliver our food. Many of us have little time, inclination or knowledge of how¹⁶³ to prepare a meal from scratch, for all to share. The proportion of people agreeing with the statement 'I love/really enjoy cooking' fell from 46% in 1989 to 41% in 1999 and the average time spent making a meal fell from an hour in 1980 to 20 minutes in 1999.¹⁶⁴ Women in particular have enthusiastically embraced the convenience of the one-stop supermarket shop, and the prepared foods on offer.

People are more likely to eat what they like, when they like, and pre-prepared or partially prepared foods provide a solution for which they are

increasingly willing and able to pay. This is especially true of people who work – those of us who do spend on average 40% less time cooking than those who do not.¹⁶⁵ Nearly two thirds of households buy ready-meals, a growth of 8% since 1995, and around 10% of us eat them more than once a week.¹⁶⁵ Ethnic foods, often made from ingredients trucked, shipped and flown in from around the world, are ever more popular – as is exotic fresh produce, much of which will have been air-freighted.

However, the high price of convenience notwithstanding, the relative amount we spend on household food is actually lower than ever before; the cost of food in real terms fell between 1989 and 1999 by 9.4%.¹⁶⁶ At £17.64 per person a week,¹⁶⁷ household food accounts for a mere 10% of household spending.¹⁶⁸ There are of course wide variations depending on socio-economic class, age group and region but the fact remains that for the most part, we expect our food to be cheap. Foods that 20 years ago, were impossibly exotic and expensive, are now abundant and affordable; we can have our avocados four for a pound now. This emphasis on driving down costs has implications for how and where our food is sourced, it often being cheaper to import from overseas, as we discuss below.

In addition, we no longer eat (or expect to eat) seasonal, British food, partly because we know so little about how and where food is produced. One survey revealed that nearly 90% of British people do not know that beer is made from barley, 20% do not know that yoghurt is made from milk and a tenth of us think that rice is grown in the UK.¹⁶⁹ Another revealed that 86% of the population have no idea when favourite British foods, such as strawberries, are in season.¹⁷⁰ This ignorance is even greater among younger people. Often we prefer imported food over equivalent UK products, favouring cosmetic perfection and exotic flavours over the provenance of food.¹⁷¹

Although an aging population evokes images of scone-baking and jam-bottling, and perhaps a greater emphasis on seasonal, traditional foods, for tomorrow's older generation this impression is likely to be highly inaccurate. Elderly people today are far more likely than younger people to take time to cook 'properly,' but the elderly of tomorrow are simply today's children grown old, many of whom, as we have seen, cannot cook.¹⁷²

162 Office of National Statistics, 2001, www.statistics.gov.uk/cci/nugget.asp?id=263

163 Caraher M and Lang T, *Can't Cook, Won't Cook: a review of cooking skills and their relevance to health promotion*, Int.J Health Prom & Educ. Vol 37, No.3, 1999

164 Taylor Nelson Sofres survey cited in *Food Consumption 2000: the one-stop guide to the food consumer*, IGD Business Publications, Institute of Grocery Distribution, Letchmore Heath, August 2000

165 *Food Consumption 2000: the one-stop guide to the food consumer*, IGD Business Publications, Institute of Grocery Distribution, Letchmore Heath, August 2000

166 *Supermarkets: a report on the supply of groceries from multiple stores in the United Kingdom*, Competition Commission, 2000

167 *National Food Survey 2000*, Office of National Statistics, 2001

168 *Expenditure and Food Survey 2001–2*, Office of National Statistics 2003

169 Taylor Nelson Sofres survey reported in *Food & Drink Europe*, www.foodnavigator.com/news/news.asp?id=7459

170 *Safeway Champions Seasonality Within its Premium Range – The Best*, news release, Safeway, 28 February 2003

171 *Consumer Watch 2001: consumer attitudes to food and grocery issues*, Institute of Grocer Distribution, December 2001; *Food Consumption 2000: the one-stop guide to the food consumer*, IGD Business Publications, August 2000

172 *Winning the Mature Vote*, Institute of Grocery Distribution, Letchmore Heath, 2001

Hence tomorrow's pensioners will be much less likely to cook meals from scratch, choosing instead to eat convenience foods.

The consequences of this shift towards eating internationally sourced, complex manufactured foods is that food is travelling further than ever before. There are, however, also signs of a small but growing interest in how and where food is produced, leading to increasing sales of organic, local and Fairtrade produce. The Institute of Grocery Distribution comments: *'While the pace of globalisation has undoubtedly risen, there has been a corresponding revival in local heritage. This is partly a result of recent food scares such as BSE and a perception that local means higher quality and trustworthiness, with consumers often prepared to pay a premium. Global branding could risk minimising choice at a time when consumers want more, not less.'*¹⁷³

4.3 The global supply chain

Globalisation affects almost every aspect of our personal and public lives. It is happening across all sectors and the food industry is no exception. Manufacturers, located more in our minds and on our billboards than in any specific physical place, are now sourcing from one side of the world and selling to another. Many British retailers, having built up a strong customer base at home, are now expanding into Europe and further afield, while European and American retailers, such as Lidl, Netto and Walmart, are establishing footholds here in the UK. This process has been made possible by the removal of trade barriers, lower labour costs in the developing world, rapid developments in ICT (discussed below) and transport costs which, relative to the overall cost of the product, are very low. The wave of large-scale mergers and acquisitions in the late 1990s provided added impetus for globalisation, as has the streamlining and rationalisation of major companies' brand portfolios¹⁷³ – the kind that has turned Marathon, a UK chocolate brand, into the globally marketed Snickers. Consumers, as we have seen, with their desire both for cheap, and for exotic food, are also driving the trend.

Most of the signs suggest the food industry will continue in this globalising direction.¹⁷⁴ The launch of the Euro in 2002 has given the process

a strong boost; increased price transparency reduces currency risk and helps retailers source the same products at lower cost from new suppliers. This process is repeated by manufacturers further down the supply chain.¹⁷⁵ Logistics specialists responding to a pan-European Delphi survey by Heriot-Watt University felt that the retail sector will continue to become more concentrated both in Europe and in the UK and that the influence and market share of international retailers will grow.¹⁷⁵

The global food retail market

At the global level, the food retail market is worth an estimated \$2.8 trillion. Most of the market for global food retailers – 70% – is in ten countries, with the US (18%), Japan (15%) and China (8%) the three largest consumers.¹⁷⁴ However the IGD predicts that for global retailers, the most promising opportunities for the future are in China, Russia and Italy, closely followed by Japan, Hungary and India.¹⁷⁶ Tesco indeed already has a presence in Japan and Hungary.

The IGD also forecasts that the top twelve European retailers will increase their share of the global food retail market from 37.4% to 60.5% although retail will still remain one of the least global industries; as a perishable product, food is unlikely ever to be as globalised as, say, pharmaceuticals or automotive parts.

Global food manufacturing

The more that retailers globalise their markets, the more they globalise their supply chains. For food manufacturing, Delphi survey respondents¹⁷⁷ anticipated that production would become even

173 *Future Focus: the future of global sourcing*, Institute of Grocery Distribution, Letchmore Heath, March 2002

174 *Global Retailing: the future*, IGD Business Publications, Institute of Grocery Distribution, Letchmore Heath, November 2000

175 McKinnon A and Forster M, *Full Report of the Delphi 2005 Survey: European logistical and supply chain trends, 1999-2005*, Heriot-Watt University Logistics Research Centre, Edinburgh, July 2000

176 *The IGD Global Market Index*, Institute of Grocery Distribution, Letchmore Heath, 2003

177 McKinnon A and Forster M, *Full Report of the Delphi 2005 Survey: European logistical & supply chain trends, 1999-2005*, Heriot-Watt University Logistics Research Centre, Edinburgh, 2000

more concentrated, perhaps by as much as a quarter between 1999 and 2005, particularly at European and global levels.¹⁷⁷ Eastern Europe emerges as the most appealing region for setting up factories, followed by Southern Europe; the appeal of Northern and Western Europe is likely to dwindle.

Other surveys^{178,179} also show that European firms are sourcing less from within their home markets, while the Delphi survey also predicts that industry is likely to buy more and more from manufacturers operating multinationally. Indeed the share of purchases from suppliers who trade only in the home market is anticipated to decline by 13%, and the proportion sourced from enterprises with European or global reach to increase by 11% and 23% respectively. This trend is expected to continue at least until 2005 with more and more supplies being sourced particularly from Eastern Europe (21% growth) and the Far East (14% growth).

A general pattern is thus emerging: big companies will get bigger and stronger, and the small ones smaller and weaker.

Centralised distribution

Warehousing and storage trends also point in the direction of fewer and bigger, consistent with the centralisation and consolidation process of the last 30 years. Other research bears this out. In their efforts to reduce costs throughout the supply chain,¹⁸⁰ many of the supermarkets are adopting the fewer but bigger approach – not so many, but larger, distribution centres – served by a network of local consolidation centres which initially consolidate the goods before they make their way to regional and national distribution centres. This does not, however, mean that direct

deliveries are made from the local consolidation centres to nearby stores.¹⁸⁰

Fewer warehouses and processing plants mean longer distances to be travelled between them, a trade-off which makes economic sense given the high cost of land and the difficulties of securing planning permission, relative to the low cost of transport. This said, a significant minority of the Delphi panel (15%) felt that firms would start to decentralise the way they held stocks, so leading to an increase in storage points¹⁷⁷ and hence to shorter journey distances. We discuss the implications for CO₂ emissions in section six.

Just in time and other supply chain innovations

A major logistical development over the last 20 years has been the emphasis on more frequent, timely, and reliable deliveries which seek to minimise stocks at all stages in the supply chain. There is a plethora of jargon to describe this goal – 'lean' and 'agile' logistics systems, quick response, Efficient Consumer Response and so forth. Just in time (JiT), the grandfather of all such philosophies, is ultimately about achieving a stockless, waste-free supply chain, although not all JiT systems match the ideal. Such systems seek, among other things, to reduce storage and other costs, minimise waste at every point in the supply chain (including by not delivering unwanted goods), and to supply goods only when – not before or after – they are needed. The glossary at the back provides a few definitions.

In the food industry, this pressure to go down what is in effect the mobile warehousing route has come mainly from the supermarkets. According to research by McKinnon and Campbell,¹⁸¹ suppliers in the frozen food sector face intense pressure to reduce their order lead times and deliver smaller quantities of goods more frequently. The pressure comes less from the wholesalers than from the supermarkets, who accounted for 61% of the total sales of firms in a sample taken in 1998.

The supermarkets for their part are anxious to keep stockholding rates to a minimum and to increase the rate at which it turns over – in other words to achieve a bulge-less flow of goods, ready and available as and when wanted rather

178 Kearney A T, *Logistics Excellence in Europe*, European Logistics Association, Brussels, 1993

179 Kearney A T, *Insight to Impact: results of the fourth quinquennial European logistics survey*, European Logistics Association, Brussels, 1999

180 Finegan N, *Backhauling and Factory Gate Pricing: evolution or revolution?* Institute of Grocery Distribution, Letchmore Heath, UK, February 2002

181 McKinnon A and Campbell J, *Quick-Response in the Frozen Food Supply Chain: the manufacturer's perspective*, Christian Salvesen Logistics Research Paper 2, Heriot Watt University, Edinburgh, June 1998

than accumulating in expensive and limited storage centres. In the years 1996 to 2002 the top four supermarkets reduced their average stockholding of fast-moving grocery products from 10.61 days to 9.6 days.¹⁸² Planning restrictions and cost have played an important part here. The supermarkets have limited cold-storage capacity at RDCs. This means they have had to improve their use of the very expensive space available; the McKinnon-Campbell study found that the top four retailers increased their average warehouse space utilisation from 82.7% to 85.8% between 1994 and 1997. Taking into account seasonal fluctuations, this means that RDCs are working very close to capacity¹⁸¹ and therefore, in terms of energy use, fairly efficiently.

The elimination of waste also has clear environmental benefits, including a reduction in physical resource use and in the pointless transport of goods which are not used because they are lost as waste. However as with all things there will be trade-offs, some of which could outweigh the environmental gains. It has, for instance, been suggested that JiT-type systems lead to increased transport¹⁸³ because smaller quantities of goods are delivered more frequently, in smaller and less efficient vehicles. This, it is argued, has been one of the main drivers of freight growth.

For example, the European Commission's 2001 Transport White Paper¹⁸⁴ partly attributed the growth in lorry traffic to '*changes in production methods of the manufacturing industry which have led more and more towards stock-reducing, flexible, diverse, rapid and tailored transport with reductions in shipment size and increases in shipment frequency.*' One test of whether JiT is indeed increasing average vehicle-kilometres is therefore the question of whether average payload weights (see glossary) are indeed diminishing.

In fact, opinion on this point is somewhat ambivalent. European research into the impact of JiT across a number of sectors concludes that there is no evidence that at an aggregate level JiT is reducing vehicle loading. On the contrary, there appears to have been a net consolidation of loads across national vehicle fleets.¹⁸⁵

Moreover, and more specifically, a look at UK data on the payload weights of food, drink and

agricultural products reveals that in the last 10 years there has been an overall increase in average payload weight.¹⁸⁶ How the picture is affected by changes in the types of foods we are now eating is not clear; it may be that the increase in average payload weights is related to the growth in easy-to-stack convenience foods (meaning vehicle are more fully loaded), but this is speculation.

Other (non food-related) research into JiT and its environmental impact¹⁸⁷ concludes more generally that while an efficient JiT system will generate more vehicle-kilometres than an efficient non-JiT system (and an inefficient JiT is very bad indeed), most non JiT systems are highly inefficient and hence their replacement by an efficient JiT system can lead to overall environmental savings. To quote: '*JiT distribution involving consolidation may well generate considerably fewer vehicle kilometres than an inefficient non-JiT system. And the reality is that many existing transport operations probably fall in to the inefficient conventional category.*'¹⁸⁷

Finally, a note of caution: there is some doubt that food distribution systems can, strictly speaking, be classed as JiT. Although little-and-often principles of JiT apply, many deliveries are in fact scheduled ones, and as a result there are opportunities to consolidate loads and ensure that vehicles are filled to their maximum capacity.

182 *Retail Logistics 2003*, Institute of Grocery Distribution, Letchmore Heath, November 2002

183 Whitelegg J, *Freight transport, Logistics and Sustainable Development*, World Wildlife Fund, Godalming, 1995

184 *European Transport Policy for 2010: time to decide*, Commission of the European Communities, Brussels, 2001

185 *Redefine: relationship between demand for freight transport and industrial effects*, final report, Contract No. RO-97-SC.1091, European Commission, Brussels, February 1999

186 *Continuing Survey of Road Goods Transport – comparison of payloads in 1991, 1996 and 2001 for agricultural products, food and drink*. Although there was a slight fall in payload weights for agricultural products in 2001, this is likely to have been a temporary consequence of the outbreak of foot and mouth disease.

187 Allen J, *Just-in-Time Transport*, Comment. Issue Number Three, Exel Logistics/BRS, Bedford, 1994; more recent research into the environmental impact of JiT is not available

Factory gate pricing

Factory gate pricing (FGP) is one of the more significant logistical developments of recent years (see glossary) and forms part of the ongoing effort to reduce costs in the supply chain. Factory gate pricing builds upon the growing trend towards the backhauling of goods, mainly packaging. Sainsbury's and Tesco have taken the lead in developing and trialling such systems and now almost 30% of the cases delivered to Tesco's distribution centres arrive on Tesco trucks.¹⁸⁸

FGP is still in the early stages of development and has not yet been widely adopted, and so its effect upon mileage is uncertain. Advocates argue that FGP will reduce overall transport requirements because return journeys can be used to pick up from suppliers or return packaging, so eliminating the need for a second vehicle to perform the task. Some, however, have challenged the suggestion that FGP will lead to environmental benefits, arguing that many suppliers own and operate their own lorries which, after dropping off a delivery at the depot, go on to deliver to other customers.¹⁸⁹ Under a factory gate pricing system manufacturers will have to make dedicated journeys, possibly leading to an overall increase in transport once both these and the retailers' journeys are added together.

An alternative possibility is that, with the extra cost of making these deliveries, manufacturers may feel that it is no longer cost-effective to deliver to their smaller customers. This in turn undermines the smaller retail sector, and forces them to make separate arrangements for receiving deliveries of these goods. These will generate additional travel and could outweigh the efficiencies achieved by FGP.

Whatever the merits or demerits of FGP it is also important to bear in mind that in 2001 only around 12.5% of the food industry volume of cases was backhauled:¹⁹⁰ for every 100 tonnes of goods a retailer receives, only 12.5 tonnes on

average will arrive on a vehicle which has previously dropped off a delivery somewhere else, and which is therefore making use of the return journey. This does not mean that for 87.5% of the time the returning lorry is empty because on many occasions it will be used to return pallets and packaging, but it does suggest that there is considerable scope for improving the efficiency of the delivery process.

Information and Communication Technologies

The Internet and developments in ICT have also made a vital contribution to the globalisation process, with implications for the logistics industry and for freight mileage. The dot-com bubble may, as the cliché goes, have burst, but the influence of the Internet on all aspects of business life has continued to grow steadily. Home deliveries and online auctioning sites such as e-bay are just the more visible aspects of e-commerce. The vast majority of Internet-based dealings are between businesses (B2B) rather than between businesses and customers (B2C). The Internet provides a huge opportunity for business to sell more, faster, to more people, further afield. The same applies to its dealings with other businesses. The Internet also opens up the market to smaller players. This of course will not necessarily mean shorter supply chains as these smaller players could be located several thousand miles away.

For business, ICT has made logistical life much easier. For instance ordering, invoicing and paying for goods can be carried out accurately at the click of a mouse rather than with erratic and irascible photocopiers and fax machines. Vehicle tracking, routing and scheduling systems can also optimise efficiency as section three highlighted. Other developments include e-based freight exchanges which provide a virtual platform from which carriers can sell or auction space in their vehicles, either on the outward or return journey, to businesses who want loads carried. This reduces empty running and thus maximises vehicle efficiency.

Home shopping is, however, that part of the e-chain that attracts the most publicity and attention is now being paid to its environmental implications.¹⁹¹ At the moment, opinion is divided

188 *The Grocer*, William Reed Publishing, West Sussex, 18 January 2003

189 *Supermarket Sweep?*, *Logistics Manager*, May 2002

190 Finegan N, *Backhauling and Factory Gate Pricing: evolution or revolution?* Institute of Grocery Distribution, Letchmore Heath, February 2002

as to whether the system will lead to more or less freight mileage. One Swedish research project¹⁹² examined existing deliveries to 15 shops, restaurants, schools and day nurseries and then modelled an 'ideal' pattern based on vehicle optimisation and shared vehicles. The study found that this improved model could reduce the distance travelled by 39%, the number of vehicles used by 42% and the number of journeys by 58%.

A report prepared for the RAC Foundation estimates that home shopping will reduce car-based shopping by 5% by 2005 and 10% by 2010. This outweighs a forecast increase in delivery traffic of 0.25% and 0.5% respectively. It also estimates that greater use of ICT will reduce goods mileage by 17% by 2005 and 19% by 2010.¹⁹³

Research that focuses specifically on grocery home shopping is also cautiously optimistic. The conclusion here is that supermarket home deliveries are unlikely to increase overall traffic levels and, with the right policies in place, could lead to important reductions.¹⁹⁴ Another study into grocery shopping, commissioned by the Department for Transport, also concurred with this judgement, concluding that 'the corresponding increase in van miles used for delivering orders to householders is more than offset by the major reduction in car miles.'¹⁹⁵

For others however, e-commerce is likely to generate more traffic, not less. A report from the Dutch Association of Transport Operators, Transport en Logistiek Nederland,¹⁹⁶ claims that e-commerce will lead to a 17% increase in road journeys in the Netherlands by 2005. The figure – comprising an 8% increase through consumer purchases and 9% through business-to-business transactions – is on top of a 21% increase in road journeys resulting from the 'old economy'.

Closer to home, a report commissioned by English Partnerships concludes that 'it is more than likely' that expanded home delivery will cause an increase in household trips, and that the type of trip generated will have a 'disproportionate effect' on congestion, by increasing traffic largely in residential areas.¹⁹⁷ It should also be remembered that 40% of deliveries fail¹⁹⁸ because people are not at home. This means that an additional journey needs to be made, creating more emissions.

With regard to e-commerce as a whole (as opposed to home deliveries) one US research organisation is entirely upbeat, concluding that e-commerce will help reduce inefficiencies in the distribution system, underplaying the second order impacts that could emerge.¹⁹⁹ However a major study by Forum for the Future into the implications of the digital revolution for sustainable development was more cautious.²⁰⁰ The logistics chapter of the study suggests that the first order effects of e-commerce may indeed be positive, by reducing wastage and inefficiencies in the supply chain. However the second order impacts are uncertain and could well be deleterious.²⁰¹ The two most significant possibilities are first, that the easy and cheap availability of goods online will stimulate overall consumption (meaning more goods travelling) and, second, that the impetus to supply chain globalisation that e-commerce provides will lead to a significant increase in air freight. As far as

191 Wilsden J (ed), *Digital Futures: living in a dot-com world*, Earthscan, 2001

192 Cited in Hopkinson P and James P (2001) *Virtual Traffic: the impact of e-commerce on logistics and the implications for sustainable development*, in Wilsden J (ed), *Digital Futures: living in a dot-com world*, Earthscan, 2001

193 *Motors and Modems Revisited: the role of technology in reducing travel demands and traffic congestion*, National Economic Research Associates (NERA), London, May 2000

194 Cairns S (forthcoming), *Delivering Supermarket Shopping: more or less traffic?* Transport Reviews, Taylor & Francis, London, ISSN 0144-1647

195 Palmer A (unpublished), *Environmental and Congestion Implications for Grocery Home Shopping* (draft report), Retail Logistics Task Force, DTI and DFT

196 *New Wine in Old Flasks*, Transport en Logistiek Nederland, Netherlands, 2000

197 *A Research Study Into Potential Collection Points for English Partnerships*, DTZ Research, April 2000

198 *Home Delivery: the hype and reality*, Focus Magazine, Institute of Logistics and Transport, Corby, June 2003

199 Romm J, *The Internet Economy and Global Warming: a scenario of the impact of e-commerce on energy and the environment*, The Centre for Energy and Climate Solutions, Virginia, United States, December 1999, <http://cool-companies.org/ecom/pr.cfm>

200 Wilsden J (ed), *Digital Futures: living in a dot.com world*, Earthscan, London, 2001

201 Hopkinson P and James P, *Virtual traffic – the impact of e-commerce on logistics and the implications for sustainable development in Digital Futures*, in *The Impact of e-commerce on Society and the Environment*, Wilsden J (Ed), Earthscan, London, 2001

the first is concerned, it is too early to say whether this is actually happening, but the authors do point out that the Amazon website has expanded the market for books. They comment: *'Whilst this expansion is not due solely to price – online retailers may tap some latent demand by offering easier access than existing stores – it seems to have been an important element.'* This tendency has in fact been true of traditional retailing – 50 years ago only the privileged few had a television and now even the very poorest households have one. Many homes today have two or three.

Whatever the potential future benefits of home deliveries, the system as it currently stands is fairly chaotic and inefficient. To quote one industry insider:²⁰² *'There are a number of systems problems ... complex paperwork, lots of rekeying, going into orders more than once, no information flow between activities and systems such as picking and transport – how do you relate the two back to each other? If there is no volume information for each assignment, how do you know how full that van is going to be? The loading of the van, the optimised utilisation of the van, is just not possible ...'*

Whether or not it has been fuelled by home shopping, we are certainly seeing an increase in van and light vehicle deliveries. LGVs are less efficient than HGVs in terms of fuel use per weight carried. Given the likely growth in e-commerce, more research into light van goods movements is needed.

Transport costs

All the above underlines the point that sophisticated ICT notwithstanding, the rapidly escalating globalisation process would be impossible without the trucks, the ships, and the aeroplanes that physically deliver the goods and, crucially, the cheap fuel that powers these vehicles. At the end of 2002, grocery distribution costs in the UK were at their lowest level in three

years, accounting for an average of 3.44% of sales. Of this 3.44%, warehousing costs constituted 56.1% and transport, 34.8%. In other words, the cost of transport comes in at just over 1% of the end price of the product.²⁰³ The more processed the good, and hence the higher the final sale price, the less important, relatively speaking, the cost of transport is, even though the product itself may well have travelled further than a less processed one.

Of course 1% of £103.8 billion (the total food market in the UK) is a great deal of money, hence the food industry's desire to shave off inefficiencies (and so gain competitive advantage) through FGP and by deploying some of the technological and managerial options discussed in section three. The general conclusion of the Delphi survey was that over the next six years freight transport costs would be fairly influential in deciding the location of warehouses. On a scale of one (no importance) to five (critical factor), freight transport costs were given an average rating of 4.3 for warehousing and 3.4 for manufacturing locations. Nevertheless commercial gains for large companies from global sourcing and retailing are so great that unless economic structures change very dramatically indeed, transport costs are unlikely to impede the trend towards globalisation.

By way of a final qualifying point, there are industry warnings that although global sourcing will continue to grow, *'Consumer resistance will be the key barrier to the growth of global sourcing.'*²⁰⁴ The likelihood of this consumer turnaround is explored further in section five.

4.3 International and national institutions

The food industry does not operate in a political vacuum. Trade between countries and continents has been occurring for thousands of years, with the rate and pace of it increasing in line with our capacity to move and communicate across long distances.

In the decades after the Second World War, a number of institutions were set up, including the General Agreement on Tariffs and Trade (GATT, superseded in 1995 by the WTO), the CAP and the EU, their aims being to promote trade and

202 Sears-Black C, Isotrack, quoted in *Home Delivery: the hype and reality*, Focus Magazine, Institute of Logistics and Transport, Corby, June 2003

203 *UK Retail Logistics Overview*, Institute of Grocery Distribution, Letchmore Heath, 2003

204 *Future Focus: the future of global sourcing*, Institute of Grocery Distribution, Letchmore Heath, 2002

economic prosperity for the countries involved. All these institutions have given the globalisation process a very powerful impetus.

Many non-governmental organisations (NGOs) have been forceful in their criticism of these institutions, arguing that they have promoted the agendas of the rich while damaging the world's poor and the environment. The purpose of this section is not to offer yet another critique but rather to explore the influence that these complex interrelated institutions have had upon the growth in food transport.

Food in the free market

The World Trade Organisation (WTO) aims to reduce barriers to international trade in order to achieve free and fair terms of trade for all participating members. A succession of agreements both before and since the WTO ministerial talks at the Doha Summit in 2001 has ostensibly sought to achieve this. However the WTO is also dominated by its most powerful members, the US and EU Member States, and it has notably failed to prevent these countries from continuing to subsidise their own farmers heavily while placing tariffs on imports. In the case of the EU these subsidy support systems amount, directly and indirectly to over \$300 billion a year.²⁰⁵

At the same time the World Bank and the WTO have required developing world countries to eliminate import tariffs and other barriers, to stop subsidising farmers and to use their comparative advantage in agricultural production to grow cash crops for export, in keeping with free market principles.

This combination of subsidies on the one hand, and free market based structural adjustment on the other, has created a distorted international market which has exacerbated the growth in food transport.

There are several reasons for this. Subsidised overproduction of commodities such as milk products and sugar in the developed world, are often transported to and dumped on developing countries, even though the latter can produce these foods themselves. Dumping creates freight movements. It also undercuts developing world producers who cannot compete with the low

prices²⁰⁶ and in so doing creates a dependence on transport-intensive imports, which in turn leads to further freight transport.

In addition, developing world producers of products such as tea, coffee and cocoa face stiff competition amongst themselves, and overproduce in order to compensate for the very low world prices created both by such competition and by international commodity traders. Surplus goods mean more goods moving, and therefore more transport-generated emissions.

Agricultural specialisation has also created a situation whereby countries that were traditionally self-sufficient in staple foods now import them, with additional food transport being one consequence. Indonesia is one example: from a position of self-sufficiency in rice in the 1980s, it now accounts for around 13.5% of world rice imports.²⁰⁷

The transport story does not end with commodity crops. In the developing world, very low labour costs, together with the open-house policies of governments desperate for inward investment, combine to create a favourable environment for multinational food manufacturers to set up food processing and packing operations. These companies are able to add value to cheap raw commodities profitably, enabling them to expand and globalise their operations further. Examples of such multinational activities include chicken processing in Thailand and Brazil, and trimmed vegetable preparation in Kenya.²⁰⁸ The consequence is ever longer supply chains, with the environmental impact of that transport not fully internalised in the final cost of the product.

These market distortions have together led to the generation of unnecessary freight movements. However, market liberalisation, while generally acknowledged to be necessary in order to

205 BBC News, *Doha Trade Deal Unravelling*, November 2002 <http://news.bbc.co.uk/2/hi/business/2436803.stm>

206 EU CAP Reforms a Disaster for the Poor, news release, Oxfam, Oxford, 26 June 2003

207 See: <http://r0.unctad.org/infocomm/anglais/rice/sitemap.htm>

208 Processing at the point of production also reduces the transport of what eventually ends up as waste but the point is that these foods are sourced from far afield because of the low cost of labour and other costs relative to those in the developed world

improve the terms of trade for the developing world,²⁰⁹ will not necessarily lead to a reduction in food transport. While the removal of a subsidy structure may lessen the incidence of dumping and hence reduce these kinds of food movements, it is also likely to lead to an increase in the production of other (particularly processed) foods for export, with all the transport that this creates. The 2001 *Everything but Arms* initiative agreed between the EU and a number of low-income developing countries, aims to foster more open trading arrangements for the developing world. While welcome from an international development perspective,²¹⁰ it will also allow increased imports of certain commodities over the next decade and probably lead to a growth in food transport.

Liberalisation in China and Eastern Europe will give added impetus to the growth in transport mileage, as will the enlargement of Europe. Indeed, with ten new countries joining the Union, we could see the pattern of food production in Europe shifting in new directions, with regions previously enjoying little access to EU markets able to exploit their competitive advantage – in fruit and vegetable production for example.²¹¹

This may further damage the competitiveness of British farmers still trying to recover after the onslaught first of BSE and then foot and mouth disease. Despite the hugely expensive CAP subsidy system, 60% of British farmers receive individually less than £5000 in annual

subsidies;²¹² the average UK farmer earns a mere £11,000 a year²¹³ (less than half the national average of £24,600)²¹⁴ for working over 60 hours a week, and many farmers are unable to recoup even the cost of production.²¹⁴ The consequence of this is that there are few new entrants to the profession.²¹⁵ Indeed, in the six years up to 2002, nearly 65,000 jobs were lost in the UK's agricultural and horticultural industry.²¹³ While some farms have consolidated and expanded, many others have suffered, and are in decline. As a result, manufacturers are looking overseas for supplies, so exacerbating the shift towards longer supply chains.

At the 2003 EU Agriculture Council, attempts were made to untangle the situation and free up the trading system while furthering environmental and social objectives. These attempts have met with limited success, as discussed in section seven.

In addition to its subsidies structure, other aspects of the CAP have also contributed to the growth in food mileage. For example the emphasis on specialised intensive agriculture has led to a decline in mixed farming systems, and the segregation of different types of farming (arable, livestock, horticulture) into different regions. This in turn has reduced the ability of regions to be self-sufficient in agricultural products.

At the national level, government has begun to develop farming policies which aim to build a stronger and more environmentally sustainable British farming base. We discuss these in the next section.

There are of course many other policies which, while not specifically focused on the food industry, nevertheless have an impact on the way it works and on the freight movements it generates. State aid rules, for instance, more or less prohibit governments from favouring indigenous production over imports on the grounds of environmental or any other considerations.²¹⁶

4.4 Conclusion

A number of very strong influences have helped to lengthen our food supply chains. These include the rules governing international trade, together

209 *The dangers to Doha: the risk of failure in the trade round*, speech by Clare Short at Chatham House, 25 March 2003, Department for International Development, www.dfid.gov.uk

210 *Everything but Arms and Sugar?* Oxfam Parliamentary Briefing 13, Oxfam, Oxford, 2000

211 Baldock D, *Local Food Sourcing: a changing policy context*, Institute for European Environmental Policy, Wise Moves seminar, Transport 2000, London, 31 October 2002

212 *Farmgate: the developmental impact of agricultural subsidies*, ActionAid, London, 2001

213 *UK Agricultural Review*, National Farmers' Union, 2003, www.nfuonline.org.uk

214 *Patterns of Pay: results of the 2002 New Earnings Survey*, ONS, www.statistics.gov.uk cci/article.asp?id=364 cross-industry figures for PAYE registered employees working full-time

215 *UK Agricultural Review: farming in crisis*, National Farmers' Union, June 2002

216 Although there are some ways around this, see section seven

with other economic policies, notably the low cost of transport relative to other production costs (especially labour), increasing specialisation in the British and global agricultural industries, competition regulations, and state aid rules that have made it difficult for governments to internalise external (including transport-related) environmental costs. These factors have helped nurture the rise of powerful global manufacturing industries and retailers that depend upon an elaborate international supply network to provide

for a public that is not necessarily aware of, or interested in how food is produced, and which demands, and gets, around-the-clock availability of just about everything. Unless these things change, the indications are that supply chains will only get longer. However there are also some (albeit small) indications of counter-trends. Whether these amount to an important shift in direction for the food supply chain or not depends upon the context in which they develop over the next few years. This is discussed next.

Section five

The business approach: Anticipating and preparing for the future

A number of factors are likely to influence the food industry's direction over the next five to ten years. A viable business will be one that negotiates a financially successful path through an often unpredictable obstacle course of threats and opportunities. It will also be one that anticipates and prepares for the future by considering whether small or latent existing trends are likely to grow in importance.

Figure 3 illustrates some of the questions that a business might consider before embarking upon any new course of action.

This section considers whether some of the slight counter-currents to the globalisation process highlighted in the previous section might, in combination, place curbs on the current trend

towards ever longer supply chains. It begins by examining the broader geo-political issues affecting existing sourcing patterns, including climate change and other challenges to the resilience of the supply chain. The discussion then moves on to consider more specific recent and evolving policy developments. Lastly, this section looks at consumer attitudes, asking whether there are signs of a growing demand for food which is sourced from closer to home.

It should be emphasised that the purpose here is not to ask whether measures to shorten supply chains or source more locally are desirable from a CO₂ perspective. That is the remit of the next section. It is simply to consider the extent to which there are trends moving in this direction,



Figure 3

how powerful they are and therefore whether, commercially speaking, it makes sense to pay attention to them.

Whether or not these trends have merit in terms of carbon reduction, any measures to reduce CO₂ impacts from transport and from other life-cycle areas will need to take the commercial perspective into account; anticipating where trends may lead will be part of this process.

5.1 The big picture: Food supply in a risky world

In an ever more globalised world, events taking place thousands of miles away can have profound effects on a business.

Increasingly, policy makers and business leaders are realising that they need to consider and plan for the potential risks (internal and external) to which their supply chains are exposed.²¹⁷ Events such as foot and mouth disease, BSE, consumer antagonism to GM foods, the UK hauliers' fuel protest, the (only retrospectively unscary) Millennium bug and the September 11 terrorist attack have all underlined the importance of planning for contingencies – but also the difficulties of so doing. The war against Iraq and the rapid spread of the SARS virus in the spring of 2003 (and the likelihood of viruses such as these taking hold again) add to the uncertainty.

Might nearer be safer?

Given that there is a clear business case for fortifying against potential vulnerabilities, is there a specific risk-avoidance argument for shortening the supply chain?

This is a difficult question to answer. All supply chains are exposed to risk of one kind or another²¹⁸ and although a shorter supply chain will be not be vulnerable to some of the risks threatening a global one, the reverse is also true. The risks may be different but not necessarily of less magnitude. Some have argued that a well-prepared business will be one that develops as broad a supply and market base as possible in order to spread its risks and respond to events with agility. Recent agricultural and global crises have in fact impressed upon retailers the need to widen the food network; during the 2001 fuel

protest, businesses were actually more able to source goods from the Continent than from within the UK, because the fuel was easily available across the Channel. Those with the most local supply and distribution bases were worst affected.²¹⁹ Hence, committing to sourcing everything from one region might be considered a rather risky eggs-in-one-basket approach.²²⁰

Nevertheless, a globalised sourcing structure is particularly vulnerable to some very specific risks. These include, most prominently, the threat posed by international terrorism, the volatile situation in the Middle East following the war in Iraq and our rapidly dwindling stocks of oil. All have implications for the security of our supply chains. There are signs that the freight industry is becoming highly conscious of these risks. A Freight Transport Association survey for January 2003 revealed that 76% and 35% of respondents have formal contingency plans to deal with possible fuel supply disruptions and transport infrastructure failure respectively.²²¹

Oil is the transport fuel of choice. In the year 2000 oil fuelled the vast majority of vehicles and this accounted for around a third of total oil consumption in the UK.²²² Oil is also the fossil fuel with the lowest global reserves to production ratio and (although it is possible that new reserves will be found in Central America and Canada) could potentially be in short supply before 2050.²²³

217 Cranfield School of Management, *Supply Chain Vulnerability: final report on behalf of DTLR, DTI and the Home Office*, Cranfield School of Management, Cranfield, 2002

218 Peck H, *Supply Chain Vulnerability*, presentation prepared by Helen Peck of Cranfield School of Management for *Exploring the business case for more local food sourcing and distribution*, seminar organised by Transport 2000, London, 31 October 2002

219 Maxwell S, WorldWide Fruit, personal communication, 2002

220 *Key Findings: exploring the business case for more local food sourcing and distribution*, Transport 2000, October 2002

221 *Quarterly Transport Activity Survey*, Freight Transport Association, Tunbridge Wells, January 2003, www.fta.co.uk/information/otherissues/trends/qtas/030226QTAS.htm

222 *UK Energy in Brief*, Department for Trade and Industry, London, December 2002

223 Eyre N, Fergusson M and Mills R, *Fuelling Road Transport: implications for energy policy*, Institute for European Environmental Policy and Energy Saving Trust, London, 2002

Traceability is another issue to consider. The more complex and elaborate our supply chains and the greater the range of food on offer, the more difficult it is to know exactly where food comes from and how it has been produced. The recent devastating outbreak of foot and mouth disease, for instance, is likely to have originated from outside the UK, although the exact source is unlikely ever to be identified.²²⁴

It has been argued that bigger companies have more transparent and traceable supply chains than smaller companies, because they have the resources to put in place the appropriate infrastructure and procedures, whatever the length of the supply chain.²²⁵ In early 2003, Sainsbury's announced measures that will eventually allow customers to use the Internet to track all own-label British organic fruit and vegetables back to the farm, as well as other products from around the world. The company also announced plans to extend the concept to other fresh organic areas including meat and dairy produce.²²⁶

These measures reflect the importance companies place on consumer concerns but they also highlight the fact that major companies are able to develop such technology. It is unlikely that smaller retailers would be able to afford such an investment. Similarly, consumers' aversion to genetically modified foods has caused the major food businesses to go to great lengths to ensure that their own-brand products are GM free. Smaller local enterprises are very unlikely to have been able to make this stand against the GM industry.

On the other hand, although Due Diligence requirements will apply whatever the size and type of business, the smaller the enterprise, the

shorter the distances involved, and the more direct the link between the supplier and the consumer, the less need there may be for elaborate traceability systems. The success of farmers' markets is due both to the shortness of the supply chain and to personalised trading relationships. As such initiatives grow and become more prevalent, it will be interesting to see whether they manage to continue without abuse of trust on either side.

While bigger companies are sometimes better able to absorb shocks than smaller ones, thanks to their ability to switch sources of supply very rapidly, when major businesses do fail, they fall spectacularly, with recent high-profile cases illustrating this point. Of course the picture is more complicated than this since most small businesses – small grocery stores and newsagents for instance – also source globally via their wholesalers. What is evident is that more work needs to be done to develop risk-management strategies which differentiate on the basis of near and far.

The effects of climate change

Climate change, and its impacts, is an area of potential vulnerability. For business, its significance falls into two categories; the effects upon the physical environment, and the political and legislative responses these effects provoke.

In physical terms, climate change will affect agricultural systems, making existing types of food production in some regions no longer viable, while opening up potential in other areas. For UK agriculture, climate change will mean a longer growing season, fewer frost days, more peak temperature days, more rain in winter and less in summer, and increased atmospheric CO₂ levels.²²⁷ There are also implications for livestock production – animals may well suffer from more heat stress and disease. People's food tastes will change too – hotter days will mean more demand for salads and ice-cream and less for warming stews and mashed potato – and business will need to respond to these changes. Hotter average temperatures may also cause an increase in industrial (and domestic) use of refrigerated storage; a requirement which will lead to the generation of additional greenhouse gas emissions.

224 *Origin of the 2001 Foot and Mouth Disease epidemic*, news release, Department for the Environment and Rural Affairs, London, 20 June 2002

225 Comment offered at *Wise Moves* workshop, *Exploring the business case for more local food sourcing and distribution*, Transport 2000, 31 October 2002

226 *JS net tracks British organic own label*, *The Grocer*, William Reed Publishing, West Sussex, 22 February 2003

227 Hossell J, Clemence B and Roberts A, *Food Sourcing under a Changed Climate*, ADAS Consulting Ltd, paper prepared for *Exploring the business case for more local food sourcing and distribution*, seminar organised by Transport 2000, London, 31 October 2002

Although climate change may favour more indigenous production of some crops such as soya, sunflowers and wine grapes that have hitherto been imported, it is not automatically the case that climate change will shift sourcing patterns in a more local direction. What is more likely is that we will simply make a different set of sourcing decisions. The heat-wave and absence of rainfall in July–August 2003 cut maize and sugar-beet yields in Italy by a quarter, and wheat yields have fallen by a third in Portugal.²²⁸ Other major European crops, including peaches, pears and olives have been severely damaged.²²⁹ One prediction puts the cost of the heat-wave to Italy at more than €6 billion, with one million hectares of crops damaged.

We are unlikely to grow all these crops ourselves instead. What is more likely to happen is that we will simply source from elsewhere – perhaps from Northern and Eastern Europe, or, further still, from China. These changes will not necessarily lead to reductions in transport; for some crops, food miles will grow.

However, in addition to the agricultural impacts, the food supply chain will also have to contend with disruptions to the logistics infrastructure caused by extreme weather events such as floods and violent storms. These are serious threats. It is possible that big business will cope with some of these by developing technological and other solutions, in the form of sturdier air freight carriers, better flood prevention measures, different siting of warehouses and so forth. The extent to which these will counter the disruption will depend upon the severity of the events we experience.

To what extent, then, do climate change and other vulnerabilities in the supply chain threaten the current pattern of sourcing from ever further afield? By its very nature, an answer about risk will not be definite. Threats to the security of the supply chain could come from unpredictable sources both at home and abroad. However, in the short term it may be that the policy actions to tackle climate change and other environmental concerns (some of which are discussed below) will have a greater effect on food sourcing and distribution patterns than the physical consequences of climate change itself.

5.2 Do economic and legislative policies favour shorter supply chains?

To what extent does the international political and economic context favour a shift towards more local patterns²³⁰ of food sourcing and distribution? Section four has argued that historically these policies have often had the opposite effect, fostering (or at least not hindering) the development of longer supply chains. Many of these policies continue, and as such the impetus for lengthening supply chains remains.

However, there are also qualifying counter-trends, which suggest that in small but possibly significant ways some practical restraints are being placed on the globalisation process. In addition, policies are being implemented that increase the relative appeal of more local sourcing options.

UK farming and food initiatives

In December 2002 Government formally responded to the Curry Commission's report with the publication of *Facing the Future*.²³¹ This report outlines Government's strategy for improving the competitiveness and environmental sustainability of UK food and farming. While critics felt the report was weak in some respects,²³² it is likely that in future years we will see more support for sustainable UK production, and more of an emphasis on local and regional foods.

Some of the policies that may encourage this regional approach include various agri-environment schemes, and the Organic Action Plan. The latter aims that British farmers should supply at least 70% of the UK organic market, compared with the existing 30%, although it does

228 *Heatwave's Warning for Future of Farming*, *New Scientist*, 20 August 2003, www.newscientist.com/news/news.jsp?id=ns99994072

229 *Heat Damage*, *The Grocer*, William Reed Publishing, West Sussex, 9 August 2003

230 The term is meant in its relative sense here; nearer rather than further sourcing

231 *Facing the Future: the strategy for sustainable farming and food*, Department for the Environment, Food and Rural Affairs, London, December 2002

232 *More Action Needed for Sustainable Farming Future*, news release, Friends of the Earth, London, 12 December 2002

not specify a date by which this should be achieved. It also puts in place a number of measures to enable and encourage both public procurement bodies and retailers to source organic food from within the UK.²³³ As well as plans to increase organic production within the UK as a whole, the Organic Action Plan also commits DEFRA to work with the organic sector to develop healthy and growing sales of local and regionally grown organic food. On the other hand, *Facing the Future* includes strategies to increase exports of organically grown food, which will have the effect of increasing food transport.

As part of its vision for sustainable farming and food, government has also charged the Regional Development Agencies (RDAs) with developing regional food strategies. Most of the RDAs are still in the very early stages of the process and the outcome remains to be seen, not least because the funds available are fairly modest. In principle, however, this devolution of responsibility to the regions could provide opportunities and incentives for the food industry to source more from within the UK as a whole, and even from within the region. The emphasis is, however, on stimulating the production and marketing of 'value-added' foods, rather than on everyday staples. As such these policies may not provide real incentives for business to shift away from their existing sources. It is more likely that they will simply supplement their existing product ranges with regionally sourced value-added foods.

Food from Britain (FFB) has also received a major boost in funding, and has taken on what was previously the Countryside Agency's responsibility for promoting regional foods. Again, FFB's focus is on value-added, niche 'locality' products, and its remit is to promote these foods overseas as much as within the UK. Thus while the activities of FFB will probably increase availability of certain value-added products within the UK, they will do little to halt the trend towards longer supply chains.

There is also the Food Chain Centre (FCC). Housed at the IGD, its activities include work to promote benchmarking among farmers (to improve efficiency and reduce costs), and to explore ways of improving efficiency in the red meat chain through, among other things, more collaboration across the supply chain. It is also supporting some minor work on horticulture, aided by a small grant from DEFRA. As with the other initiatives, the emphasis is on adding value to the supply chain through, for instance, food processing. The transport implications of value-adding and food processing are discussed in section six.

If successful, the work of the FCC may help improve the competitiveness of UK food production, and as such may encourage some product substitution by retailers. On the other hand, it may simply enable them to add UK products to their existing globally sourced range – a matter of supplementing, rather than replacing. Once again, the initiative is still in its early stages and there is as yet no evidence to report.

The re-launched Little Red Tractor Scheme²³⁴ covers more basic agricultural commodities, such as cucumbers and chickens. State Aid regulations prohibit any government-funded scheme from directly promoting the Britishness of foods, and Tractor foods do not have to be British. However, in most cases they are just that. The intention is that in time the Tractor mark will subsume all the other quality assurance marks that are currently on offer around the UK, but this is likely to be a long and difficult process. As it stands, the Tractor scheme has been severely criticised by animal welfare and environmental organisations, who argue that products bearing the mark only have to meet the very minimum (and in their view, inadequate) legal standards.²³⁵ Nevertheless, from a supply chain perspective, it may be that the scheme raises the profile of UK produced foods among consumers. As such it may provide an incentive for businesses to source more from within the UK instead of from further afield. This is, however, speculation; we are not aware of any research which has analysed the impact of the scheme on retailer sourcing patterns or on consumers' interest in buying British food.

The English Collaborative Board is yet another initiative. The board has set up the English Farming & Food Partnership (EFPF) to promote

233 *Action Plan to Develop Organic Food and Farming in the UK*, Annex 2, DEFRA, London, July 2002, www.defra.gov.uk/farm/organic/actionplan/actionplan.htm

234 See: www.littleredtractor.org.uk

235 *Little Red Tractor Under Fire*, BBC Wales, 21 March 2003, www.bbc.co.uk/wales/southwest/farming/digest/stories/2003-03-21logo.shtml

collaboration within the supply chain – between farmers, and between farmers and other food industry players. Again, it is too early to see what effect the EFPF will have on the British farming sector but if successful, it may strengthen the commercial case for sourcing more from within the UK.

The signs seem to be that, at the national level at least, a policy framework is being established that in some measure favours the commercial case for sourcing more from within the UK, and even for more local and regional supply chains. However, the focus is on niche, value-added products rather than on everyday staples. From a commercial perspective, this is understandable; these products have the clearest chance of success as they are obviously different from the many others available to shoppers. People pick them up, say 'this is different' and buy them, even if they are more expensive. There is evidently a clear commercial case for selling more of these products and many supermarkets are already doing just that.

We have suggested, however, that these goods will serve as add-ons to the existing repertoire of goods on offer, rather than providing incentives for product substitution. As such while we may see the development of more UK-based and regional supply chains it is doubtful whether they will replace the existing longer ones.

In addition to measures that seek to promote UK, regional and local sourcing, businesses will also be mindful that other government policies provide incentives that tend in the opposite direction. The low cost of transport relative to other costs, both for national and international freight transport, is a clear example here. In addition, it is an explicit Government policy to foster and encourage globalised trading systems.

Aviation policies

Aviation is one transport policy area with a strong bearing on business food sourcing decisions. An *Aviation White Paper* is likely to be published in early 2004. It remains to be seen what this contains but at the moment, from an environmental perspective, the signals Government is sending appear to be somewhat contradictory.

On the one hand, Government is looking at the options for developing a form of aviation

emissions charge, or fuel tax, for domestic freight and passenger flights. As a member of the International Civil Aviation Organisation (ICAO) and the EU, it is also urging the development of an international and/or Europe-wide emissions charging scheme at the earliest opportunity. This issue is discussed in more detail in section seven, where we offer our own suggestions.

On the other hand, the Government is eager to press ahead with a major programme of airport expansion in the UK, some of which (in the East Midlands region particularly) provides for an increase in airborne freight. The effect of this will be to make air freighting goods both cheaper and more convenient, so providing incentives for business to place more reliance on short-order globalised purchasing structures. When the EU-wide aviation emissions charge comes into effect (see section seven) this may have a further bearing on business sourcing decisions. Much, however, will depend on the level of charges set and the precise nature of the scheme.

European policies

At a European level too, we have already highlighted the fact that the enlargement of Europe may well foster longer supply chains and that businesses are in particular looking at setting up manufacturing locations in Eastern and Southern Europe.

To this point should be added the obvious fact that EU (and at an international level, WTO) legislation also places restrictions on attempts to promote indigenous production at the expense of overseas imports. As such, international policies will continue to support the long supply chains of the food industry.

European transport policies do not seem to be doing much to mitigate the effects of such expansion. The *European Transport White Paper* published in September 2001²³⁶ will, commentators suggest²³⁷ provide little disincentive to the growth in transport-intensive distribution systems.

²³⁶ *European Transport Policy for 2010: time to decide*, European Commission, Brussels, September 2001

²³⁷ *Opaque Commission Adopts Toothless Tiger*, press briefing, T&E: European Federation for Transport and the Environment, Brussels, 12 September 2002, www.t-e.eu/press_briefings.htm#17/10/01

There has been some speculation as to the possible impact of the soon-to-be-implemented Working Time Directive on freight journeys. The directive will place legal limits on drivers' working hours. Some have argued that this may force an increase in transport fleets, to take into account the fact that more drivers will be needed to do the same job; indeed Lex Transfleet warns that the directive will mean a 12% increase in the number of journeys, although what the effect on total tonne-kilometres might be is not clear.²³⁸ On the other hand, the directive may provide incentives for businesses to adjust their supply chains by, among other things, looking for sources closer to home. One industry figure has commented: *'We need to start looking at genuinely integrated networks across Europe arranged around consolidation centres. These will act as command and control with strategically located depots bounded by four-hour drive zones to comply with the new EU Working Time Directive.'*²³⁹

Others, still, doubt that the impact on freight mileage will be significant either way.²⁴⁰ Congestion is far more likely to have an effect on business decision-making although it is not always the case that the shorter route will be the less congested one. It may be, however, that the Working Time Directive will have a bearing on lorry mileage in another respect. ASDA has commented that *'As far as the Working Time Directive is concerned, rail has it licked,'*²⁴¹ and that extending its use of rail is core to its strategy for dealing with the implications of the directive.

On balance then, do national and international policies favour a shift towards shorter supply chains? In some areas, the answer is a qualified yes. The post-Curry agricultural agenda has

spurred on the efforts of the major supermarkets to source and promote UK produce. It may be that in some areas of transport policy there are weak incentives for the development of shorter supply chains. On the other hand, these may well be cancelled by other policy influences that actively support the development of longer supply chains. What we may see in future years is the development of separate, parallel supply chains: one for niche local and regional foods; and another, international one, for the vast majority of the goods we eat.

5.3 Is there a market? Public opinion, ethics and transport

Do we really care how, and how far, our food travels?

On the face of it, no. As section four illustrated, it seems that on the whole what people want is an ever greater variety of often highly processed foods, at ever lower cost, available all the year round. The consequence has been longer supply chains.

However, section four also highlighted a small but growing demand for food that is not mainstream, including Fairtrade, organic, speciality and local foods. Many of these foods come with various ethical credentials attached, although all also possess other qualities that contribute to their consumer appeal. It seems though that there is a growing niche market for foods offering a moral edge. This is enabling businesses that cater for this market to make healthy profits.

The question for a business to consider might therefore be whether the food miles issue is likely to grow in importance for those shoppers who already buy 'alternative' products. And if so, how far will this concern for food miles enter the mainstream?

The following paragraphs discuss the alternative sector in more detail, exploring whether this growth amounts to an important trend, and if so, whether there are any common contributory factors. We look at this sector *not* because we necessarily equate it with a reduction in transport – imported organic food, for instance, travels further than its home-grown conventional equivalent. The purpose rather is to examine how and why non-mainstream foods can grow in

238 *Interesting Facts and Figures from the Lex Transfleet's Report on Freight*, news release, Lex Transfleet, Coventry, 1 April 2003, www.lextransfleet.co.uk/article.cfm/id/170.html

239 Godsell D, marketing and strategic development director, Christian Salvesen, quoted in *Supply Chain: an editorial supplement to The Grocer*, William Reed Publishing, West Sussex, 14 June 2003

240 Dawson J, Exel Logistics, opinion offered at *Exploring the Business Case for More Local Food Sourcing and Distribution*, Transport 2000 seminar, London, 31 October 2002

241 *ASDA Plans Increase in Rail Use to Cut Three Million Lorry Miles*, *Rail*, issue 468, EMAP, Peterborough, August 2003

appeal, and hence how other issues, including transport, enter the public consciousness.

We then explore whether concern for food miles, in particular, is growing and if so, how this affects shoppers' choice of products. Once again, our focus is on examining trends with a bearing on business behaviour, not on judging whether local food actually generates fewer CO₂ emissions.

The alternative food sector: Organic

Recent years have seen massive growth in UK sales of organic food. They are now the second highest in Europe,²⁴² reaching £920 million in 2002, a 15% increase on the year before.²⁴³ While most of this growth (60%) is driven by only 8% of consumers, 71% of us bought at least some organic food in the year 2001–2.

The signs are that this growth is slowing but sales nevertheless continue to rise. The interest in organic food is also helping boost the British organic farming sector – imports of organic food fell by 5% to 65% of sales, meaning that there has been a small but appreciable increase in home production.²⁴²

The alternative food sector: Fairtrade

Fairtrade food is another sector which has seen particularly rapid growth. More of us than ever before now have an idea of what Fairtrade is about; compare the 24% who understood what the mark stands for in 2001/2 with only 12% in 1999.²⁴⁴ What is more, we are buying as well as recognising Fairtrade products. Sales leapt by an average of 40% during 2001 – with the market for Fairtrade bananas growing by 83%. In total, £46 million was spent by the British public on Fairtrade products in 2001.²⁴⁵ By value, 14% of coffee purchases come with Fairtrade credentials (by volume 12.9% of ground coffee and a smaller but still significant 3.6% of all coffee).²⁴⁶ As interest grows, so does the range of goods on offer; over 100 products now carry the Fairtrade mark.

Neither organic nor Fairtrade food could be classed or even viewed in the public's mind as 'less transport intensive'. There are, however, also signs of growth in more overtly *local* food sectors. Here consumers may perceive there to be a connection with less transport.

The alternative food sector: Farmers' markets

The rapidly growing popularity of farmers' markets is a good example. In 1997, there was only one farmers' market in the whole of the UK, but by 2002 there were around 450. Seventy per cent of markets describe themselves as thriving.²⁴⁷

Mainstream retailers have already noted the interest in local and regional foods and most of them are, to varying degrees, now offering, or aiming to offer such foods in their stores. Most now have some form of local and regional food policy and many employ regional food buyers. In addition, since British foods are often associated with 'local' in the public mind,²⁴⁸ many supermarkets are promoting the Britishness of some of their foods. The box below highlights some examples of their activities.

Supermarkets and local food

ASDA says it has identified a £160 million sales opportunity for local products²⁴⁹ and it aims that every one of its 258 stores should sell products from at least one local supplier by 2004. To this end, in 2001, ASDA formed a central team to co-ordinate local sourcing activity. An early launch was 'the best of Cornwall and the West Country' where products such as ice-cream and biscuits were introduced to the region's stores. In the North West ASDA is stocking 80 products from 19 small suppliers based at the Plumgarths Lakelands Food Park in Kendal. The businesses are primarily family concerns.²⁵⁰ This

242 *Huge Boost in Organic Land Shows New Report*, news release, Soil Association, Bristol, 14 October 2002

243 *Food and Farming Report 2002: executive summary*, Soil Association, Bristol, 2002

244 *Fairtrade Fortnight General Action Guide*, Fairtrade Foundation, London, 2003

245 *Faircomment magazine*, Fairtrade Foundation, Summer 2002, www.fairtrade.org.uk

246 *Ethical Approach Finds Favour, The Grocer*, William Reed Publishing, West Sussex, 13 September 2003

247 *Farmers' Markets: a business survey*, National Farmers' Union, London, September 2002, www.nfu.org.uk/stellentdev/groups/public/documents/policypositions/farmersmarkets-a_ia3e5b8154-3.hcsp

248 *Consumer Watch 2003*, Institute of Grocery Distribution, Letchmore Heath, April 2003

249 See: www.asda.co.uk

250 *The Grocer*, William Reed publishing, West Sussex, 13 July 2002

initiative involved sourcing at quite a low level, with the products in one store sourced from the same town. Clearly though, if enough volume is available from the suppliers, opportunities may be available for extending their reach to other ASDA stores in the north of England. ASDA added 400 new local lines to its stores in 2002 and now has 130 local suppliers on its books.²⁵¹

ASDA has launched a Buy British campaign across all 259 of its stores and plans to invest £1.3 million in new labelling, in-store promotions, and other forms of marketing. It is also looking at ways of extending the UK growing season in a bid to combat foreign imports.²⁵² In 2003 it aims to double its supply of Scottish carrots and remove foreign imports from all stores. The retailer will source 10,000 tonnes of carrots from Scotland compared to last year's 5000 tonnes and is on course to source 100% from the UK by 2004.

Tesco also plans to put more locally sourced produce on sale at its 75 Scottish stores, following customer research which showed that Scottish consumers were keener to buy local than customers in the rest of the UK.²⁵³

Sainsbury's employs a team of regional and local buyers. The retailer stocks over 3500 products which it classes as local or regional.²⁵⁴ Some will be available on a national basis while others will be sold in only one or two stores. The company also runs Small Supplier Development Programmes in the South West and in Wales to help smaller enterprises make the transition to supplying a national retailer.

Waitrose has launched its Select range of milk sourced from a pool of 85 dairy farmers, and has made a commitment to sourcing strawberries only from the UK between June and September.²⁵⁵

Waitrose has also adopted a definition of local (from within a 30-mile radius) and has published a Small Producers' Charter.

All Safeway organic meat is now sourced from within the UK. It has also worked with Welsh hill farmers to supply Welsh stores with lamb. This has proved very successful and the lamb is now on offer in stores across the UK. Safeway also supplies its Orkney and Lerwick stores with local meat, Northumberland lamb to its Northumberland stores and local fish, meat and eggs to its Channel Island stores.

One survey²⁵⁶ found that Marks & Spencer is currently sourcing 60% of its organic produce from the UK – much greater than the 25% industry average. Marks & Spencer also sources all its milk regionally and all salmon from within the UK. It has funded the development of new UK varieties of fruit, such as the Jubilee strawberry as well as an indigenous Gala apple. Marks & Spencer has 3% of the UK food market, but it sells 16% of all apples grown in the UK.

Booths, the small North-West based supermarket chain, has built a particularly strong reputation as a seller and promoter of regional produce and in so doing has enjoyed very high growth levels indeed. It saw a 9.7% sales increase in the seven weeks around Christmas 2002, compared with 5% for Waitrose and 4.8% for Tesco, the two next highest supermarkets. Its annual sales increase was nearly 9%.²⁵⁷

251 *The Grocer*, William Reed Publishing, West Sussex, 1 March 2003

252 *The Grocer*, William Reed Publishing, West Sussex, 26 April 2003

253 *The Grocer*, William Reed Publishing, West Sussex, 14 September 2002

254 Sainsbury's, www.j-sainsbury.co.uk/csr/regional_sourcing.htm

255 *The Grocer*, William Reed Publishing, West Sussex, 25 May 2002

256 *Supermarkets failing to buy British organic produce*, Organic Targets Campaign, c/o Sustain, London http://www.sustainweb.org/pdf/20_7_02.pdf

257 *The Grocer*, William Reed Publishing, West Sussex, 18 January 2003; 1 February 2003

258 *Consumer Watch 2003*, Institute of Grocery Distribution, Letchmore Heath, 2003

The alternative food sector: Local food

The local foods market is beginning to look very lucrative indeed. Consumer attitude surveys to local food indicate a growing interest. Asked what changes they would hope to see at their local supermarket over the next year, consumers ranked *"locally-produced foods should be available"* third at 15%, after the more predictable *"prices should not increase"* (33%) and *"more special price promotions"* (18%). Interestingly, more local food ranked higher than *"food that is easier to prepare and cook"* at 6%.²⁵⁸

Another survey reinforces the finding that active interest in food production is on the increase. The survey, in 2002, found that 18% of shoppers were actively trying to improve their knowledge of food production compared with 14% in 2001.²⁵⁹ A third study found²⁶⁰ that most people (59%) are well disposed towards local foods but those who actually buy it tend to be older, female and in higher socio-economic groups. This reflects not just a greater concern for food issues among this section of the population but also the fact that they may have more access to local food than many other groups and are able to afford the often higher cost.

How important are ethics to consumers?

Taken together, the growth in organic, Fairtrade and local foods is significant. At least two questions follow. First: what, if any, are the common factors underlying this growth? Second: how does the issue of food miles fit into the picture and how might this affect business sourcing decisions?

To take the first question first: as section four showed, aside from the obvious criterion of ease of access, people choose foods on the basis of price, taste, appearance and (increasingly) its health-giving properties. In other words, their decision is based on their particular notion of 'quality for money'. What constitutes this quality for money will vary from person to person. Some, for instance, see the McDonald's arches as a sign of consistency, reliability, tastiness and general reassurance; whereas others²⁶¹ regard them as symbol of all that is wrong with post-industrialist consumerist Western society. The shopping decisions people make are based on a complex mental arithmetic which juggles the relative importance of a number of factors for any given product.

Thus while price may be very important it is not, except for a small minority, necessarily the overriding consideration.²⁶² Hence the popularity of branded products which cost more than their virtually identical unbranded counterparts. And hence too the growing popularity of organic, Fairtrade, speciality and local foods.

Most people who buy organic food cite health and food safety as the overriding reason for so doing (with environmental considerations very

low on the list).²⁶³ The success of organic babyfood, now accounting for 50% of babyfood sales, is a sign of the connection people make between purity and organic food. Linked to health, is the trust factor. It has been widely argued that there is a crisis of trust in our attitude to the food industry – we increasingly do not trust major manufacturers and food retailers to provide safe and nutritious food. The government's Food Standards Agency was set up, in part, to restore the public's confidence in the food industry.

Supermarkets are highly sensitive to issues of public trust, evidenced by the number of marketing campaigns stressing the authentic origin of products. Advertisements for Waitrose's 'Select' milk describing an 'elite pool of farmers' is one example; Sainsbury's new fruit and vegetable tracking technology is another. Local food is often promoted as a hand-picked or hand-crafted product: it is marketed as food with a human face. Most long-supply-chain food (with the exception of Fairtrade) is not.

How serious are the implications for supermarkets' existing global supply chains? The picture is somewhat complicated by the fact that apparently it is only sometimes that we don't trust the supermarkets and their big suppliers. Most of the time we continue to buy big-brand and own-label foods from the supermarkets, and with apparent alacrity, if the growth in highly processed convenience foods is anything to go by.

Of course we may continue to shop for big-brand products at supermarkets partly because we have little choice, either literally (other stores or manufactured goods do not exist), or because we

259 *Consumer Attitudes to Eat the View*, report prepared for the Countryside Agency by the Institute of Grocery Distribution, Countryside Agency, Cheltenham, 2002

260 Dawson A, *Consumer Watch*, Institute of Grocery Distribution, Letchmore Heath, 2002

261 Ritzer G, *The McDonaldisation of Society*, Pine Forge Press, United States, 1993

262 Institute of Grocery Distribution Consumer Unit, August 2000

263 *Consumer Attitudes to 'Eat the View' Part One: qualitative research prepared by the Institute of Grocery Distribution for the Countryside Agency*, Cheltenham, 2002 and *Consumer Attitudes to 'Eat the View' Part Two: store exit interviews prepared by the Institute for Grocery Distribution for the Countryside Agency*, Cheltenham, 2002

have almost forgotten that there is an alternative, or simply because we do not have time to spend looking for other foods and retail outlets. However, unless it is really the case that we are entirely at the mercy of big business then perhaps another aspect of the answer is that we do not always mean what we say. We may like to complain, but the supermarket cash tills show that we trust the supermarkets well enough to supply us and our children with safe-enough, good-enough food. It is also notable that most of our increased spending on organics has been inside those very supermarkets that we profess to mistrust.²⁶⁴

The reality is that shoppers are notoriously inconsistent, and represent an assortment of shifting incompatibilities. I may *in general* want all food to be healthy and nutritious and preferably good for the environment and society too, but *specifically* right now I want something quick, cheap and very sugary and I don't care how and where it was made. As an illustration, while the meat industry is experiencing a decline in carcass meat sales (partly brought on by food scares such as BSE and foot and mouth disease), meat-based ready-meals have been one of the strongest growth areas in the food industry.²⁶⁵ And although we are seeing a growth in the alternative food sector we are also Europe's largest consumer of that most anonymous of food stuffs, the 'savoury snack'. Indeed, the British account for 51% of total sales of savoury snacks, way ahead of the Germans at 18% and the French at 14%.²⁶⁶

Business is responding to these binary buying tendencies by adopting a similarly dual approach to their supply chain structures. As well as their regional and local buyers, supermarkets also employ global supply chain managers and are seeking to achieve commercial advantage through the globalisation of their supply chains.²⁶⁷ According to the industry magazine, *The Grocer*, evidence suggests that supermarkets are increasingly sourcing goods from the 'grey market.' This means they are choosing to buy identical but cheaper branded products from overseas because this is more cost-effective than doing business direct with the British manufacturer.²⁶⁸

Such an approach may have little impact on food transport, since British manufacturers may in any case carry out production overseas. It does however indicate that, far from being incompatible, the development of both local and global supply chains are viewed as ways of catering to two different (and both lucrative) sections of the market.

Food miles: Might consumer concern grow?

The food miles issue makes ethical demands on the consumer in ways that organics does not. The concern is intrinsically environmental. There is no obvious health message. As such, the extent to which people will buy 'low food miles' food will depend on the extent to which altruistic ethical considerations influence people's shopping decisions.

The experience of the Fairtrade sector may shed some light on the issue. With Fairtrade foods, an explicit connection is made – in terms of the message the product carries and the higher price it commands – between purchasing and ethics. The success of this sector does suggest that people do want their food purchases to make a positive contribution. The upturn in the Co-operative food group's fortunes, where ethics have become something of a selling point, is another instance.²⁶⁹ However, ethics alone are not sufficient – people will not buy something nasty just because it is good for the planet. Cafédirect, the leading Fairtrade coffee brand, has recognised and exploited this fact with a very successful marketing strategy focusing as much on the 'quality coffee'

264 *Food and Farming Report 2002: executive summary*, Soil Association, Bristol, 2002

265 *The Food Industry*, special report, *The Grocer*, William Reed Publishing, West Sussex, October 2002, www.grocertoday.co.uk/resources/marketreport.asp?r=410

266 *Brits Top the European Snack Polls*, Food & Drink Europe www.foodanddrinkeurope.com/news/news.asp?id=2163 15 May 2003

267 *The Future of Global Sourcing*, conference organised by the Institute of Grocery Distribution, London, October 2002,

268 *The Grocer*, William Reed Publishing, West Sussex, 26 April 2003

269 *Co-op Sales Boosted by Ethical Stance*, Food & Drink Europe, 28 April 2003, <http://foodanddrinkeurope.com/news/printnews.asp?id=2134>

angle as on its ethical credentials. In its own words, *'The quality message [had] long been missing from Fairtrade product campaigns and without it, in a quality-conscious consumer society, only a limited number of consumers [would] be motivated to buy.'*²⁷⁰ Following new marketing and distribution strategies, brand awareness of Cafédirect increased to 56%²⁷⁰ while Cafédirect coffee sales grew by 20% in value in 2001/2.²⁷⁰ The success of Cafédirect has also helped expand the overall Fairtrade market, with retailers such as Sainsbury's and the Co-op now selling own-brand Fairtrade products.

With local food too, ethical considerations have had a role, albeit a secondary one, to play in the sector's growth. IGD research found that for those who bought local food the desire to support the local community ranked third in importance as a reason for so doing, after freshness and quality.²⁷¹ Environmental factors featured too, both for local²⁷¹ and for organic food²⁷² although fairly low down on the list.

Social and environmental concerns do, then, play a part, provided they are convenient and consistent with self-gratification. The ethical seeds may have been sown by a small core of committed, principled and vocal consumers (and it is therefore unwise for a business to ignore them) but it is self-interest that provides the medium for the sector's growth.

On balance then, concern by some sections of the community for less transport-intensive food is likely to grow. This will have some implications for the food industry's existing, highly globalised food system. The next section discusses the relationship between transport, CO₂ and food life-cycle emissions, and what a carbon-reducing approach might mean for sourcing decisions.

However, as discussed, transport and carbon-reduction objectives are likely to be just one concern among many for the ethical consumer, and as such will be only one consideration affecting the shopping decisions they make. Equally there will still be a large section of the public who knows little and cares less about the threat of climate change. For them, in the short and medium term at least, it will be dinner as usual, and retailers are very unlikely to ignore

their demands. However, the situation can change very rapidly. With obesity a growing concern, businesses are suddenly aware that they face the prospect of potentially catastrophic litigation brought against them. Kraft's recent decision to shrink portion sizes and reduce the fat and calorie content of many of its foods suggests that businesses may wish to jump before they are pushed. It is not inconceivable that as people begin to understand what climate change means to them, something analogous may happen.

5.4 Conclusion

What are the implications for today's globalised sourcing and distribution practices? In the short term, the conclusion is qualified. Developing shorter or locally focused supply chains may make sense to some businesses, in some areas, selling certain types of food to certain customers. Increasing consumer demand for alternatively-sourced foods with an ethical dimension suggests that the food miles issue is likely to grow in importance as part of a package of concerns. There may also be commercial arguments for cultivating domestic sources of supply as a way of improving the resilience of the supply chain. However, the general thrust of international and national policy still points towards ever more globalised supply chains,

It is possible however, that things might change. A snowballing of concern by consumers about the climate-changing impact of major food companies might be one trigger. A more rapid onset of very damaging climate change effects is another. A terrorist or other threat to the global supply chain structure is a third. Far-sighted businesses will be keeping these possibilities in mind.

In the meantime however, we need to understand more clearly the relationship between sourcing decisions, transport and CO₂. We discuss these issues next.

270 See: www.cafedirect.co.uk/case_study/product.php

271 Dawson A, *Consumer Watch*, Institute of Grocery Distribution, Letchmore Heath, 2002

272 *Organic and the Political Agenda*, MORI, February 2001

Section six

Food, transport distance and life-cycle carbon emissions: Exploring the relationship

This section is the heart of the report. It examines three questions:

- First, what contribution do the transport stages of the food chain make to the UK's overall greenhouse gas emissions?
- Second, how do measures to shorten the supply chain affect the generation of greenhouse gas emissions elsewhere within the life-cycle of the product? If you cut mileage, might you, for instance, increase emissions from agricultural production?
- Third, what difference does the type of retail outlet make to overall greenhouse gas emissions?

Cooking and eating are also considered, but in rather less detail; we ask whether the highly processed foods we are increasingly eating are more or less carbon-intensive than the home-cooked foods that fewer of us now prepare.

Our discussion draws upon two separate research studies (see box opposite) which were commissioned as part of the *Wise Moves* project. The first study examined various sourcing and distribution options for Braeburn apples, cherries and iceberg lettuce. The second looked at cheddar cheese, white sliced bread and chicken (in whole carcass form).

We also base our analysis upon the findings of other relevant studies where these shed further light on the questions we raise. Except where stated, however, the conclusions we draw in this report are those of Transport 2000. Interested readers should refer to the original research reports for the original conclusions.

It is important to bear in mind that our commissioned research examined in total only six products and the additional studies cited add little

more to this number. A large superstore can stock around 40,000 product lines, many of which, as processed foods, contain a complex mix of ingredients. Given these limitations, categorical conclusions about all foods in the supply chain cannot be drawn. However, we chose the products for study with some care, considering them to be representative of the types of food that people eat and of the different supply chains necessary to provide them. The box on the next page provides a more detailed rationale for our choices.

The *Wise Moves* commissioned studies

The first commissioned study was carried out by Francis, Simons and Partners Ltd, in association with East Anglia Food Links. Focusing on apples, cherries and lettuce, it mapped the route by which two supermarkets currently source and distribute these products to their stores in Norfolk. It then modelled ways in which the supermarkets could reduce transport emissions, not by altering the source of these products but by improving distributional efficiency – by sharing distribution facilities and by increasing the loading factor of vehicles. Next, it compared existing supermarket systems and consequent emissions with the supply chains of the Norfolk-based co-operative, East Anglia Food Links (EAFL). EAFL has a deliberate policy of sourcing from as close to home possible although it sources from overseas when nearer supplies are not available. Finally, the consultants modelled a hypothetical 'improved locally focused system,' building upon the EAFL model but with an emphasis on greater efficiency.

The research parameters were as follows:

- The study only quantified *transport-related* CO₂ emissions, although it discussed, in qualitative

terms, how changes in the journey distance might affect energy use elsewhere in the supply chain, such as from production, or refrigeration.

- The researchers focused on CO₂ emissions as these are the main gases responsible for the greenhouse effect and there is a fairly simple correlation between fuel use and CO₂ emissions.
- A 12-month perspective was adopted; this meant that even for the locally focused system there were periods when the produce had to be imported.
- The researchers were asked to compare equivalent varieties of product – Braeburns for apples and icebergs for lettuces. However, they encountered difficulties here as EAFL did not offer these products to customers. Following discussion with our project partners, a broader range of varieties was accepted.
- Backhauling was not considered.
- Customer shopping was not considered.
- We chose Norfolk as a location for this study because both the supermarkets and East Anglia Food Links have a presence there.

The brief for the second research study was slightly different. Here the consultants, EcoLogica Ltd, considered the supply chains of white bread, cheddar cheese and a chicken carcass. This time, the location of the study was the north-west of England, because the consultants were familiar with the region, and because our supermarket partners and the regional supermarket studied had stores there.

The consultants calculated emissions from distributing these foods from the manufacturer to a variety of retail outlets: two national chains, one regional supermarket, and seven local stores. The latter were either independent outlets or members of a symbol group, and were spread between Manchester, Lancaster and a rural area to the north of Lancaster (Silverdale). Next, the consultants calculated emissions generated from customers travelling to and from the shops by various different modes. Third, they compared emissions resulting from the distribution leg and the customer leg respectively with total 'embodied energy' emissions (the total energy used in the product's manufacture and in any associated transport). Since they were not able to secure case-

specific information on these embodied emissions (as originally planned) they used generic data. Finally they explored the CO₂ differences which could result were the stores surveyed to source more locally. They based their calculations upon the hypothetical use of existing sources of supply within the region.

Our choice of products

All the products we chose can be grown or produced within the UK, some more easily than others. Some are very often produced indigenously (cheese, chicken), some are imported for part of the year (lettuce, apples) and others are almost always imported (cherries). Bread is always made within the UK but its constituent ingredient is sometimes imported.²⁷³ As such, comparisons can be made between short and long supply chain variants. Those goods that are imported arrive by different modes (sea, air, road) and this provides another basis for comparison. All the foods we chose are common and regularly eaten, although cherries tend to be seen as a luxury. We tried to choose products from each of the main constituents of the average British diet – animal protein, dairy, fruit, vegetable, cereal. We decided to exclude processed foods and ready-meals, despite their growing presence in the British diet because, with the funds at our disposal, we did not feel able to do justice to what would undoubtedly be an extremely complex undertaking.

6.1 Life-cycle analysis: The context

As section one showed, all aspects of the supply chain generate environmental (and other) impacts. The significant elements include the agricultural process itself; the production of packaging; the manufacturing process; heating and/or refrigeration for storage; the construction of the infrastructure (plant equipment, buildings and so forth) which enable the product to be processed and stored (whether in a distribution centre or a shop); storage and cooking in the home; and waste disposal.

²⁷³ We did not however examine wheat transport in our analysis

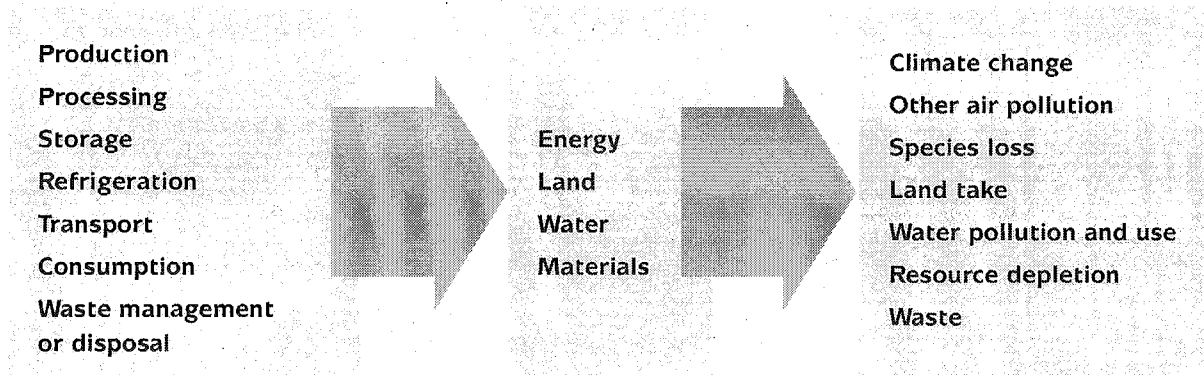


Figure 4

Defining the study boundaries

Almost all stages of the supply chain entail some form of transport. Sometimes the transport involved is obvious and considerable – trucking potatoes to a processing plant, for instance, or driving shopping home by car. Sometimes it is not. Consider, for instance, the mileage clocked up by the van of the plumber without whose services the processing plant would not be able to function. Should this be counted? Should each tiny pebble-induced wiggle in the UK's coastline be taken into account when determining its perimeter? Strictly speaking, yes, but the final calculation is not only likely to be infinite (do we get down to the atomic level?) but also not fantastically helpful for the purposes of, say, going for a walk. Most LCAs understandably draw a line before this point is reached.

There can be occasions when the accumulation of seemingly insignificant detail yields unexpected and potentially important results – a kind of chaos-inducing butterfly effect.²⁷⁴ One non food-related life-cycle study²⁷⁵ of an existing modern housing-estate home came to the striking conclusion that the minor building components – kitchen cabinets,

roof trusses, glazing, finishes and so forth – accounted for around 25% of total transport energy and 43% of total embodied energy²⁷⁶ of the house, even though they collectively made up only 2% of the total mass of the construction materials.

Moreover, once refurbishments over the life-time of the house were included in the calculations these minor components (now constituting 7% of the total mass of the house) ended up accounting for just over half of total transport energy use. These surprising findings reflect the fact that these minor elements were shipped in from very far away and required many transport movements in their manufacture. A possible parallel might be drawn here between the mainstream commodities we eat and the relatively small but highly carbon-intensive number of foods we fly in by air.

The situation can become more complicated still depending upon what the analysis chooses to focus on. Many studies confine themselves to assessing climate change impacts alone, itself a complicated undertaking. Others look at other impacts instead, or as well, such as emissions to water or other forms of air pollution.

Evidently, then, life-cycle analysis is highly complex. The outcome will depend not only on the quality of the data but upon the boundaries that are set. Hence apparently similar studies can sometimes produce very different conclusions. In June 2003 the EC issued a *Communication on Integrated Product Policy* outlining its strategy for reducing the environmental impact of products, based on the life-cycle analysis approach. This may prove helpful in developing and systematising life-cycle methodologies.²⁷⁷

The studies commissioned by Transport 2000 are not full life-cycle analyses. These require large

274 Gleick J, *Chaos: making a new science*, Viking Penguin, 1987

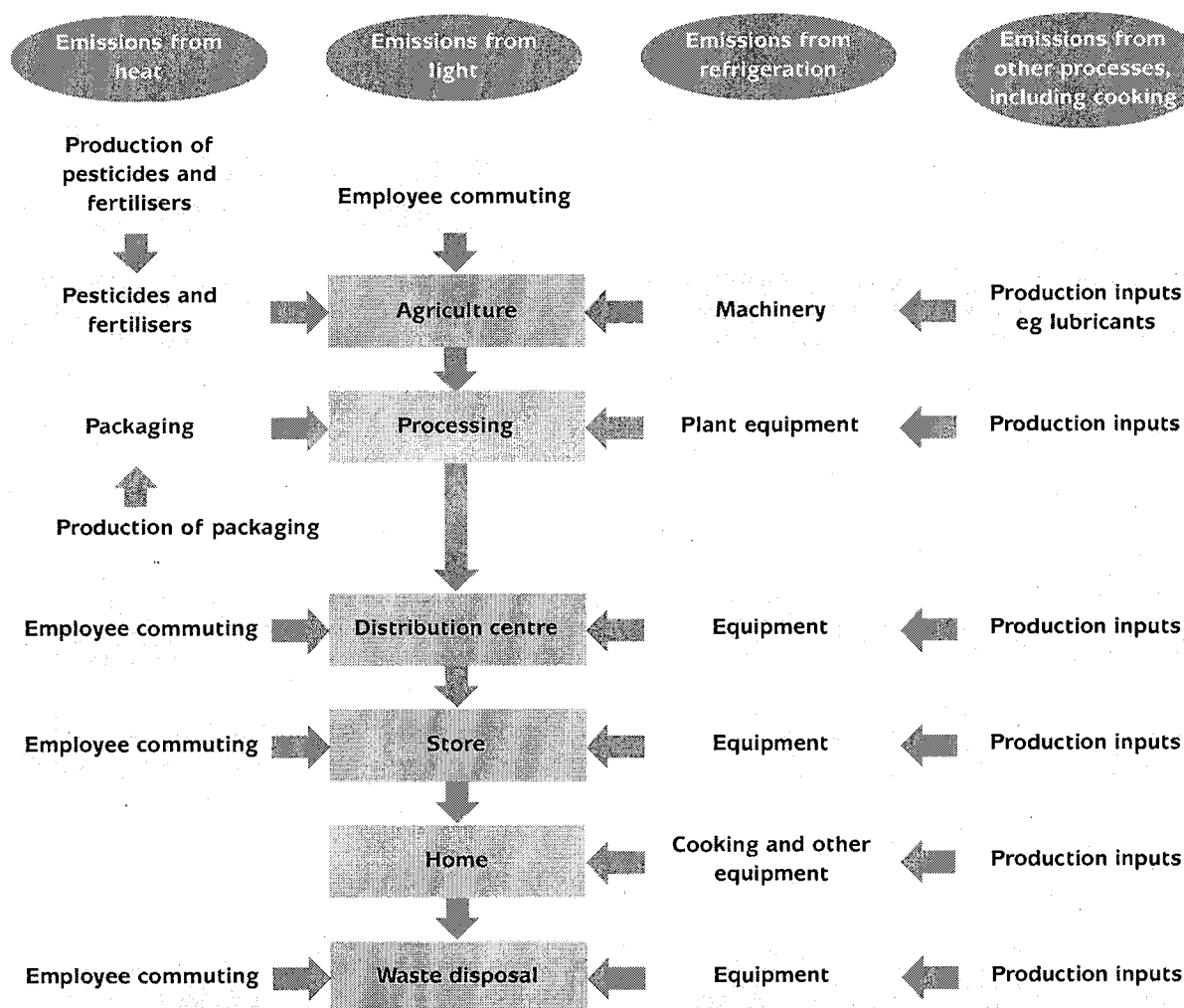
275 Critchley B, *Local Sourcing: a reappraisal of the environmental impact of building material transport*, thesis for MSc in Architecture: Advanced Energy and Environmental Studies, 1997/8 Session, University of East London, 1998

276 This includes transport energy

277 Communication from the Commission to the Council and the European Parliament – *Integrated Product Policy: building on environmental life-cycle thinking*, Commission of the European Communities, Brussels COM (2003) Final, June 2003

Figure 5 Principle sources of greenhouse gases in the food supply chain

Orange arrow indicates transport



amounts of time and money, neither of which were available. Instead, the studies focus mainly on calculating transport-generated supply chain CO₂ emissions. For non-transport impacts such as refrigeration they either (in the case of the second study) use generic, publicly available data, or else limit themselves (as in the case of the first study) to a qualitative discussion of the likely magnitude of different impacts. Even these apparently 'simple' analyses were in fact very difficult to perform, partly because of problems accessing data, and partly because the transport stages alone are full of variabilities and uncertainties.

With all these provisos in mind, then, we turn to the first question: how much of a contribution does transport make to total food-related greenhouse gas emissions?

6.2 Transport and its contribution to total life emissions

Many studies highlight the very great and growing distances that food now travels.^{278,279} Fewer, however, examine the *relative* contribution that transport makes to total life-cycle emissions. Those that exist vary greatly in their conclusions,

278 Jones A, *Eating Oil: food supply in a changing climate*, Sustain and Elm Farm Research Centre, London, 2001; and *Food, Fuel and Freeways* (see below)

279 Pirog R, Van Pelt T, Enshayan K and Cook E, *Food, Fuel and Freeways: an Iowa perspective on how far food travels, fuel usage and greenhouse gas emissions*, Leopold Center for Sustainable Agriculture, Iowa State University, Iowa, United States, www.ag.iastate.edu/centers/leopold/pubinfo/papersspeeches/food_mil.pdf

with some suggesting transport's share to be very high whilst others arguing the opposite. Evidently the conclusions reached depend not just upon the life-cycle methodology adopted (see above) but on the nature of the product itself. Here we look at some of this research, before highlighting the findings of our own commissioned studies.

One US estimate puts transport's overall contribution to total food chain energy costs at around 11%.²⁷⁹ The UK's Food and Drink Federation cites data collected by one manufacturer who estimates that the CO₂ impacts of sourcing raw materials and distributing products make up around 5% of his food chain CO₂ emissions.²⁸⁰ It is, however, unclear whether this estimate included non-UK sources.

Using Department for Transport data, we calculate that food distribution accounts for around 2.5% of the *totality of the UK's CO₂ emissions*.²⁸¹

280 *World Summit on Sustainable Development 2002*, contribution by the UK food and drink manufacturing industry, Food and Drink Federation, London, 2002

281 This does not include the customer leg

282 *Transport Statistics Great Britain (2002 Edition)*, Department for Transport, London, 2002

283 *Focus on Freight*, Department for Transport, London, 2003

284 *Transport of Goods by Road in Great Britain 2001*, Department for Transport, Local Government and the Regions, London, 2001

285 *Transport Statistics Great Britain 2002 Edition*, Department for Transport, London, 2002

286 This is an estimate based on the figure for freight transport given earlier. The assumption is made that if freight accounts for 35% of all road transport emissions and an estimated 5% is deducted for buses from the remaining 65%, then the remainder, 60%, is emitted by cars, vans and taxis

287 *National Travel Survey 1999/2001*, Department for Transport

288 The actual figure may be greater as much of the driving will take place on congested roads; this is more fuel-intensive than driving on open roads

289 In 2001, 31 million tonnes of household waste were removed for disposal, accounting for 720 million tonne-kilometres. Nearly 17% of this was made up of kitchen waste – in other words, food. Packaging of one kind or another makes up around a quarter of household waste. Nearly 70% of this is food packaging related – in other words 17.5% of household waste. In all, then, 34.5% of household waste is associated with the food supply chain. See calculations in discussion of waste in section two for more information

Our calculations were as follows:

- Road transport of all kinds accounts for 24% of the UK's CO₂ emissions.²⁸²
- Of this freight accounts for 35% of road vehicle CO₂ emissions.²⁸³
- It therefore accounts for 35% of 24% = approx. 8.4% of total CO₂ emissions.
- Food makes up 28% of total freight tonne-kilometres.²⁸⁴
- Therefore food transport is responsible for 28% of 8.4% = approx. 2.5% of total UK CO₂ emissions.

This figure is, of course, an approximation. On the one hand it excludes emissions generated by vehicle refrigeration units; including these would produce a higher figure. On the other hand the calculation assumes that the food sector employs the same mix of vehicle classes and achieves similar vehicle load factors to the road freight sector as a whole. As we have discussed, the food industry appears to perform rather better than the average for the freight sector as a whole, and this greater efficiency is likely to bring the figure down again.

To the logistics leg we might add the passenger travel to and from shops:

- Transport of all kinds accounts for 24% of the UK's CO₂ emissions.²⁸⁵
- Of this car, van and taxi movements account for 60% of transport-related CO₂ emissions.²⁸⁶
- They therefore account for 60% of 24 = 14.4% of total CO₂ emissions.
- Car-based food shopping accounts for 5% of total car, van and taxi mileage.²⁸⁷
- Car-based food shopping therefore accounts for 5% of 14.4 = **0.72%** of total CO₂ emissions.²⁸⁸

We need also to include the transport involved in disposing of consumer food waste and associated packaging. The calculations given here do not include waste produced during the manufacturing process since such data is not available. This, if included would probably increase the final figure fairly considerably.

- Food waste and packaging accounts for 0.16% of total freight tonne-kilometres.²⁸⁹

- Freight accounts for a fifth of transport-related tonne-kilometres;
- Therefore domestic food waste transport is responsible for **0.03%** of the UK's greenhouse gas emissions.

In all then, transport associated with the food supply chain accounts for nearly **3.5%** of the UK's greenhouse gas emissions. This, as we have highlighted elsewhere, is an underestimate, partly because it does not include manufacturing-stage food waste disposal but largely because it does not take into account the emissions generated while bringing foods into the UK. From our commissioned research into the supply chain of apples, it appears that the overseas leg of the journey creates almost three times as much CO₂ as the domestic journey.²⁹⁰

To confuse the matter further, in order to gauge transport's *relative* contribution to total UK-caused emissions it would be necessary not only to include transport emissions from overseas-sourced food, but also to compare these with other supply chain emissions (from agriculture or food processing) generated overseas. We would also need to compare the food sector as a whole with the relative impact of other industrial and domestic sectors, such as steel imports for the construction industry or indeed passenger air travel.

The study we commissioned into bread, lettuce and chicken found that, at roughly 1%, the distribution stage made only a small contribution to these foods' overall emissions. The 'embodied energy' of the product, calculated using generic data, was several orders of magnitude greater. However, this study defined distribution as movements from the manufacturer through to the retail outlet. It did *not* include in its definition the transport movements that took place during the manufacturing process, for instance in sourcing and assembling the raw ingredients. These were included instead in the category 'embodied energy.' If the embodied energy figure were disaggregated into its component parts, various additional transport emissions would emerge and hence transport's contribution would reveal itself to be higher.

One Swedish researcher looked at the separate elements contributing to energy use in the life-cycles of tomatoes and carrots, originating from various countries and consumed by Swedish

customers. The study focused on four key areas: the production of fertilisers, the agricultural process itself, storage and transport. For indigenously grown (Swedish) carrots and tomatoes as well as those imported to Sweden from other countries including Italy, Germany, the Netherlands, Denmark and the UK, she calculated the energy consumed and the emissions produced.²⁹¹

The researcher, Carlsson, found that the relative importance of transport compared with other life-cycle stages varied both by product and by its country of origin. With carrots, transport accounted for 21 to 43% of total emissions. Storage was more significant at 37–53%, while farm production contributed 14–28% and the production and transport of fertilisers, 4–10%.

For tomatoes, the figures were quite different. Carlsson looked at two cropping systems – high-input (intensive protected cropping prevalent in Denmark, Sweden and the Netherlands) and low-input systems (practised in Spain and 'other countries').

She found that the farm production process accounted for 94–96% of total emissions generated during the life-cycle of tomatoes in intensive cropping systems but only 28% for low-intensive cropping ones (a figure comparable to carrots, which are also not intensively produced). Transport's contribution to total life-cycle impacts was around 1–4% for highly intensive systems, compared with 39% for low-intensive ones (Spain and 'other countries'). These figures reflect the fact that the total quantity of emissions produced by the highly intensive system was, in absolute terms, very much greater than that of the low-intensive systems. Since most of these emissions were generated during the production process, transport's contribution was, in relative (although not necessarily in absolute terms, as we discuss below) not so significant. Similarly, storage

290 As we have discussed, some of these emissions will be included in other nation's greenhouse gas inventories but the point here is to calculate the transport's relative contribution to the life-cycle emissions of UK-destined products.

291 Carlsson A, *Greenhouse Gas Emissions in the Life-Cycle of Carrots and Tomatoes: methods, data and results from a study of the types and amounts of carrots and tomatoes consumed in Sweden*, IMES/EESS Report No. 24, Department of Environmental and Energy Systems Studies, Lund University, Sweden, March 1997

accounted for only 2% of emissions for highly intensive systems but 8% for low-intensive ones. Fertiliser emissions, by contrast, contributed greatly (24%) in highly intensive systems but only slightly 1% in low-intensive ones.

Tomatoes and carrots are fresh products. For processed foods life-cycle analysis yields a different set of results. Another analysis (also Swedish), found that in the case of tomato ketchup, transport accounted for only 2.4% of total energy use. While 2.4% is low, it is nevertheless 2.4% of rather a lot; the packaging and processing involved makes tomato ketchup a highly energy-intensive product. Hence total energy requirements per kilogram of ketchup amount to around 39 megajoules. By contrast the total energy used in the life-cycle of a kilogram of the fresh Spanish tomatoes²⁹² in the previous study (for which transport-kilometres represented a *relatively* more significant energy impact) consumed only five megajoules of energy.

Of course, tomato ketchup and fresh tomatoes are used in very different ways; one does not eat a kilogram of ketchup in one sitting, whereas a family of four could easily eat a kilogram of fresh tomatoes. A really thorough life-cycle analysis might have to look at the relative contribution each food made to meeting our dietary needs expressed in terms of carbon emissions per nutritionally recommended portion.

It is worth noting that the study also assumed that once opened, the ketchup would be stored in the refrigerator, in line with the manufacturer's recommendations, and concluded that this constituted a major energy impact. Given that many people, the writer included, do not store their ketchup in the fridge (with no subsequent ill effects, one might add), and that this energy impact can therefore more or less be discounted, this revises the overall energy figure downwards and as a result, increases transport's relative

share. There may indeed be a case for manufacturers to consider changing their storage instructions for some foods, a simple measure which can yield results and which has a precedent. One study by Marks & Spencer into the life-cycle of men's underpants (!) found that the most effective way of reducing CO₂ emissions was to switch from recommending a 50°C to a 40°C wash temperature.

One Australian life-cycle analysis of wheat starch concluded that transport accounted for about 18% of the total CO₂ equivalent emissions.²⁹³ Of course, Australia is more than 30 times larger than our tiny islands and it is quite possible that transport's share reflects these longer journey distances – but it shows, yet again, the variability of findings. It is also important to bear in mind the example given above of the contribution that minor building components make to the total energy use of a house. It is quite conceivable that for food too, seemingly minor ingredients such as wheat starch (which can often be ignored) would, if included, end up increasing not just the product's *total* life-cycle energy costs quite considerably, but also transport's *share* of these total energy costs. This is because, as in the case of wheat starch, transport is a relatively substantial contributor to its life-cycle energy use.

These, and in particular the 2.5% logistics figure quoted earlier, do not sound like a great deal when compared with the 22% that one study estimates the food system²⁹⁴ contributes to the UK's greenhouse gas emissions as a whole. Surely there are other more significant life-cycle areas to worry about than transport? One could argue that attention might more usefully be paid to other impacts.

Not necessarily. It is of course essential to look at other areas too but this does not mean that transport is insignificant. For a start, that estimated 22% can itself be broken down into smaller percentages. The energy attributed to food processing, for instance, can itself be broken up into lots of little two per cents (say 2% for washing, 2% for chopping, 1% for frying the onions, and so forth), all of which could be deemed essential if the product is to reach our tables in the way we expect it to. In other words, if we are not careful, figures tend to disaggregate into atomic essentials.

292 As the ketchup tomatoes were from 'Mediterranean' countries, the comparison stands

293 Narayanaswamy V, Altham J, Van Berkel R and McGregor M. *A Primer on Environmental Life-Cycle Assessment (LCA) for Australian Grains*, Grains Research & Development Corporation and Curtin University of Technology, Northam, Western Australia, September 2002

294 *Achieving the UK's Climate Change Commitments: the efficiency of the food cycle*, e3 Consulting, Holly Farm, Dyke, Bourne, Lincolnshire, 2002

Second, the distance travelled by food is growing as cost-saving efficiencies within the system (such as cheap labour in Thailand or Brazil) drive costs down, enabling the extra transport cost to be absorbed within the system as a whole. This extends to air-freighting which, while expensive, makes sense for the retailer as more and more people are willing and able to pay for premium food. Consequently we may see transport's share of total emissions growing. Our food supply chain involves more transport than any other country in Europe and the signs are that where we 'lead', the rest of Europe is likely to follow. Even those twin shrines to gastronomy, Italy and France, are now starting to embrace the convenience food culture.²⁹⁵

Third, transport mileage is itself a good indicator, or benchmark, of high energy use elsewhere. Food miles (as section two showed) have increased in line with growth in consumption of processed food. Processed food contains a very high embodied energy, not just because of the transport required in the assembly of the component ingredients but also because of packaging, heating and refrigeration. And there appears to be a correlation between growth in one area and growth in another. Food needs to be packaged more because it travels more. Food needs to be refrigerated more because it travels more. And so forth. Action to reduce food miles can be seen as compatible with other attempts to reduce the CO₂ intensiveness of our food.

This discussion leads on to the second question: what happens to overall supply chain emissions if you take steps to reduce transport? What are the trade-offs?

6.3 Is shorter better? What are the trade-offs?

The studies we commissioned into lettuce, apples, cherries, cheese, chicken and bread concluded that on the whole, and with qualifications, a reduction in transport distance could yield substantial transport-related CO₂ savings. In particular, sourcing from within the UK instead of overseas can considerably reduce CO₂ emissions from transport. For equivalent products, such as British and Spanish lettuces, the UK-sourced versions

always generated fewer transport-related emissions than the overseas-sourced ones.

The estimated transport-related CO₂ emission reductions for the products studied were as follows:

- Cherries: Around 25% if Southern European cherries substituted for some of the US imports (which are in season at the same time as their European counterparts)²⁹⁶ and 35% if the UK also expanded its production.
- Chicken (from point of manufacture): Up to 90% but typically between 40–70%.²⁹⁷
- Cheese (from point of manufacture): Over 60% savings and up to 92%.
- Apples: Up to 45% (averaged over a year and including summer imports).
- Lettuce and bread: No reduction was identified, for reasons we discuss below.

These assessments take into account the need to provide a year-round supply of these foods (with the exception of cherries which are in any case not available even in supermarkets all year) and they seek as far as possible to compare like varieties with like. This was not always possible; Braeburns, one of the UK's best-selling apples are not grown to any great extent in the UK and hence alternative, less popular varieties would have to be offered instead. They also allow for the fact that more local systems are likely to use smaller vehicles which, in terms of tonnes carried per kilometre travelled, use more fuel and hence pollute more than large goods vehicles.

However these studies were not able to calculate what effect the reduction in journey distance would have on other supply chain emissions. The downside of cutting transport distance includes the possibility that the nearer manufacturing plant – the dairy, bakery or abattoir, for example – could be less energy efficient, consuming larger quantities of electricity and gas to produce the same amount of product as compared with the

²⁹⁵ *The European Ready Meals Market*, Leatherhead Food International, Surrey, June 2001

²⁹⁶ Mason R, Simons D, Peckham C and Wakeman T, *Wise Moves Modelling Report*, commissioned by the Wise Moves project, Transport 2000, June 2002

²⁹⁷ These take the manufactured product as their starting point

more distant, larger scale plant (unless of course the nearby manufacturer happens to be large and efficient). Alternatively, the local agricultural process may be highly energy-intensive; compare UK protected lettuce production versus field-based continental systems. It may also be the case that the opposite is true; many studies suggest that small-scale agriculture is more productive (in terms of outputs per land area and other inputs) than larger scale farming, both in developed and developing world contexts.²⁹⁸ On the whole, however, there is a general presumption that economies of scale lead to greater efficiencies than their smaller counterparts. What is clear is that a comparative analysis needs to be undertaken.

While this lack of full life-cycle analysis is undoubtedly a limitation, we nevertheless feel that the commissioned studies have helped move the discussion forward.

Cherries

For cherries, the consultants highlighted possible trade-offs between transport and refrigeration. Cherries have a short shelf life and need to be temperature controlled. Air-freighted cherries are not refrigerated during the flight, although they are in the lorry journeys at each end. Road-hauled cherries from Turkey are refrigerated for five days. Either way, refrigeration is a relatively less important factor for cherries than for apples, because of their short life span.

Whatever the environmental balance between trucked Turkish and air-freighted American cherries, the CO₂ impact of both of these supply chains is very high. The consultants concluded that moves to source cherries more from

Southern Europe²⁹⁹ would help reduce emissions. However, industry opinion has it³⁰⁰ that European cherries tend to be of lower quality than Turkish or US ones. However Italian growers contacted by the consultants felt that quality was less influential a factor than the lower cost of Turkish labour. It would be possible for European countries to improve the quality of their offerings and become more competitive, but growers have invested in other fruit, such as peaches and nectarines, and are unwilling to change.³⁰¹ European growers would need to invest significantly in improving harvesting and in infrastructure such as packhouses. A simple switch by European growers to cherries, from peaches and nectarines, might also mean that UK buyers would need to go elsewhere – possibly further afield – to meet demand for these fruit.

Chicken and cheese

With chicken, the comparisons were between mainstream chicken producers, all British (except for one Irish producer), and so the trade-offs were likely to be less pronounced. This was also true for cheese, as the local creamery studied was fairly large in scale. The study did not trace the constituent ingredients (such as milk for the cheese or chicken feed for the chickens) back to their sources but offered the opinion that the different suppliers probably used similar types of supply for these constituent ingredients – in other words, supplies that were nationally sourced and distributed. As such the average distances travelled for the constituent ingredients would be similar for all producers.

Lettuce

For lettuce, the consultants³⁰² felt that attempts to extend the UK growing season would, because of its dependence on heated glasshouses, be counterproductive, leading to greater overall supply chain emissions. They did however raise the possibility that hardier alternatives to iceberg lettuces could be grown – lambs lettuce or sorrel, for instance – although again there could be trade-offs associated with the need to pick and wash such fiddly little leaves. They also highlighted examples of growers in the UK and Ireland who are using wind and/or solar power to heat, ventilate and irrigate their greenhouses and polytunnels.

298 Rosset P M, *The Multiple Functions and Benefits of Small Farm Agriculture*, Policy Brief 4, Food First, Oakland, California, September 1999, www.foodfirst.org/pubs/policybs/pb4.html

299 Or even building up UK production – although this is a very temperamental crop

300 Maxwell S, WorldWide Fruit, personal communication, 2002

301 Mason R, Peckham C, Simons D and Wakeman T, *Wise Moves Modelling Report*, commissioned by the *Wise Moves* project, Transport 2000, June 2002

302 Mason R, Peckham C, Simons D and Wakeman T, *Wise Moves Modelling Report*, commissioned by the *Wise Moves* project, Transport 2000, June 2002

Bread

Bread is sourced fairly locally by all retailers and the consultants felt that there was little room for localising further.³⁰³ A full life-cycle analysis which took into account attempts to localise the source of the main ingredient, flour, would be an important exercise but since the necessary time and money was not available, we confine ourselves here to a general discussion. Currently, 83% of the wheat flour used in the UK is indigenously produced – a significant increase over the situation 15 years ago when the proportion was only 62%.³⁰⁴ Since most of this flour (over 60%) is used for bread-making, the chances are that a standard loaf will use a high percentage of British flour. This said, the proportion is likely to be less than 83% since bread-making requires the use of flour with a high gluten content and North American wheat is particularly suitable for this. The exact proportion will vary from company to company but one of the bread brands which the consultants looked at (Warburtons) mainly uses Canadian flour.³⁰⁵ Hovis bread, however, is made mostly from UK flour.³⁰⁶ With bread the customer's potential contribution to total CO₂ costs is also very significant, as we discuss later in this section.

Apples

With apples the picture is somewhat complex. Apples are indigenous to the UK and a year round (or most of the year round) supply would be possible if a broader mix of varieties were used, and stored. As we discussed in section four, this may not sit readily with what consumers apparently want to eat – ideally the big, round, sweet apples which tend to be grown elsewhere. As regards the environmental impacts, the expansion of UK apple production raises the possibility of several trade-offs. The UK's climate is harsher than that of, say, France and so more UK apples are spoiled through frost and disease.^{307,308} This, however, may be offset by the possibility that some overseas apples are spoiled during transit and will be wasted.

When it comes to imported apples, the mode of transport makes a big difference to the carbon count. The environmental impact of transport from New Zealand by sea is not dissimilar to that

of transport from southern Europe by road, even though the distance involved is far greater.

Storage considerations add to the complexity. Once picked, apples are stored in a controlled atmosphere at 2°C throughout the supply chain. New Zealand apples can only be stored in the UK for three months (because of a UK government levy which is imposed on New Zealand apples) while British and European apples can be stored for longer. As a result New Zealand fruit appears to generate lower refrigeration emissions. But this is not a complete answer, for several reasons. For a start, refrigeration emissions during the sea crossing from New Zealand will be relatively greater than those emitted from land-based cold storage systems. Second, for the time when New Zealand apples are not available, apples from somewhere else will be eaten instead, and these too will have been refrigerated. As a result, the overall refrigeration requirements do not go down just because for some months of the year New Zealand apples will be eaten.

The storage issue also raises the possibility that the benefits (in terms of reduced transport) of stepping up UK apple production and storing them to extend the UK apple season, need to be balanced against any increases in emissions that may result. But in fact indigenous and imported varieties are stored for similar lengths of time – up to six months – and will produce similar quantities of emissions. Indeed emissions may be marginally greater for imports since they will have spent some time in less efficient mobile refrigeration units.

303 Ecologica, *Wise Moves Modelling Report: sourcing and distribution options for bread, and chicken*, report commissioned by the *Wise Moves* project, Transport 2000, June 2003

304 *The UK Flour Milling Industry*, National Association of British & Irish Millers, London, 2003
www.nabim.org.uk/images/pdf/facts.pdf This increase is thanks largely to the breeding of higher gluten varieties, together with innovations in bread baking techniques and technologies

305 Warburtons website: www.warburtons.co.uk/about_warburtons/faqs/index.html

306 Rank Hovis, personal communication, September 2003

307 Maxwell S, WorldWide Fruit, personal communication, 2002

308 This is not true of all crops – some do very well indeed in the UK climate

There have been other studies of apples and their supply chains. Jones³⁰⁹ takes a life-cycle approach, examining the supply chains of apples originating from four sources: imported (from New Zealand), sourced nationally, sourced locally (within 40km) and home-grown (at the bottom of the garden), and distributed variously to a supermarket, an independent grocer, a street market and through a home box scheme in two areas of the UK: Denbigh³¹⁰ and Brixton in south London. At both locations Jones considered all possible sourcing / retailing combinations and for all of these calculated the carbon emissions that were generated during the apples' life, including agricultural production, storage and transport.

Jones also uses a range of representative values (taking into account possible variations in type of vehicle, distance and load), and presents minimum, average and maximum energy values for each transport leg. He assumes that a local or regional supply of apples could be provided for most but not all of the year and that traditional, rather than modern, storage techniques would be used. He does not discuss how much waste might result from these storage techniques, nor does he examine issues relating to consumer taste and demand.

Jones found that locally sourced apples are responsible for 87% fewer CO₂ emissions than imported apples purchased at a supermarket in Brixton (285g CO₂/kg apples). And buying apples through a home delivery box scheme instead of from a supermarket in Denbigh results in a 96% reduction in CO₂ emissions.

He also found there to be a direct relationship between the distance apples travel and other life-cycle impacts, such as emissions from refrigeration. The further the apples travel, the longer they spend in refrigerated storage. He does however point out that this is not necessarily the case for UK production systems which require irrigation or protection. In these instances, the energy consumption of cultivation increases and the production stage becomes more significant.

309 Jones J A, *The Environmental Impacts of Distributing Consumer Goods: a case study on dessert apples*. PhD Thesis (unpublished), Centre for Environmental Strategy, University of Surrey, Guildford, Surrey. 1999

310 A small town in a rural area of North Wales

311 *Heatwave's Warning for Future of Farming*, New Scientist, 20 August 2003, www.newscientist.com/news/news.jsp?id=ns99994072

Lessons from other research: Carrots and tomatoes

The Swedish study into carrots and tomatoes discussed above addresses just this issue. For carrots, it appears that the closer to home (Sweden) they are sourced, the fewer overall emissions they produce, as Table 4 shows.

There is considerable variation according to the country of origin. For Italian imports to Sweden, transport emissions are greater than storage emissions. The opposite is true for indigenous carrots. At some distance between the Netherlands and Italy lies a critical point beyond which emissions from transport outweigh in significance emissions from other sources, suggesting there may be an optimal radius within which suppliers could source. Importantly, there also appears to be a correlation between transport mileage and storage impacts. The further the carrots travel the more energy is also spent storing them. There is less variability for other areas of the life-cycle.

Meanwhile, an increase in indigenous tomato production would create CO₂ emissions – revealing how difficult it is to make generalisations across food categories. A domestically grown Swedish tomato emits nearly twice the quantity of CO₂ of its Spanish counterpart. This suggests that the Swedes may be better off importing tomatoes. With our milder climate the conclusion for the UK may not be so clear cut.

However, even when a current strategy of importing horticultural produce may make immediate sense, in the long term it might not, both commercially and environmentally speaking. Southern European horticulture is increasingly facing the prospect of serious water shortages, partly because of the changes in global climate.³¹¹ This in time could lead to a decline in Southern Europe's horticulture industry and will require British retailers to seek other sources of supply, which may be more distant still, thus entailing additional transport.

Alternatively the Southern European industry may put in place remedies, such as artificial irrigation systems, which are themselves either energy intensive or which exacerbate in other ways the effects of climate change.

Moreover, just because Spanish tomatoes are less carbon-intensive than (for Sweden) indigenously grown ones it does not follow that the amount of

Emissions in CO₂ equivalents for carrots and tomatoes

Table 4 Carrots

Country of origin	Source of emissions	Emissions expressed in g CO ₂ equivalents – 20 year perspective	
		A*	B*
Denmark	<i>Transport</i>	22	85
	Storage	46	180
	Farm production	30	110
	Production of fertilisers	8.1	31
Denmark total		110	400
Netherlands	<i>Transport</i>	42	150
	Storage	67	240
	Farm production	23	80
	Production of fertilisers	4.8	17
Netherlands total		136	482
Germany	<i>Transport</i>	3.5	120
	Storage	7	240
	Farm production	2.6	90
	Production of fertilisers	0.77	26
Germany total		14	475
Great Britain	<i>Transport</i>	2.1	100
	Storage	4.9	250
	Farm production	1.7	89
	Production of fertilisers	0.52	27
Great Britain total		9	477
Italy	<i>Transport</i>	39	270
	Storage	36	240
	Farm production	13	87
	Production of fertilisers	3.9	27
Italy total		92	626
Sweden	<i>Transport</i>	420	70
	Storage	630	100
	Farm production	480	79
	Production of fertilisers	170	28
Sweden total		1700	280
'Other countries'	<i>Transport</i>	11	270
	Storage	12	300
	Farm production	6.5	150
	Production of fertilisers	1.4	35
'Other countries' Total		31	760
Total per capita/average per kg		2100	310

Table 5 Tomatoes

Country of origin	Source of emissions	Emissions expressed in g CO ₂ equivalents – 20 year perspective	
		A*	B*
Denmark	<i>Transport</i>	35	78
	Storage	38	84
	Farm production	2400	5100
	Production of fertilisers	21	48
Denmark total		2500	5600
Netherlands	<i>Transport</i>	410	150
	Storage	160	71
	Farm production	10,000	3600
	Production of fertilisers	59	22
Netherlands total		11,000	4100
Spain	<i>Transport</i>	660	300
	Storage	140	67
	Farm production	470	230
	Production of fertilisers	410	200
Spain total		1700	810
Sweden	<i>Transport</i>	120	68
	Storage	66	38
	Farm production	7000	3800
	Production of fertilisers	82	47
Sweden total		7200	4200
'Other countries'	<i>Transport</i>	66	240
	Storage	170	640
	Farm production	68	260
	Production of fertilisers	55	210
'Other countries' total		360	1400
Total per capita/average per kg		23,000	3100

* Column A shows the g CO₂ equivalent for the total quantity of each product the average person eats a year from each country source.

* Column B shows the g CO₂ equivalent emitted per kilogram of product from each country source.

carbon they emit is acceptable. Instead of importing tomatoes it might, for Swedish consumers, be better still to eat something else with a lower carbon footprint but which approximates in terms of taste (sour-sweet), function (sandwich filler or salad ingredient, for instance) and nutrition. Beetroot might be one possibility here or indigenously produced Swedish carrots, which emit a third less carbon equivalent per kilogram than Spanish tomatoes.

We note, furthermore, that just because the *share* of an impact is low it does not mean that in absolute terms those impacts are slight. For instance, although the production of Dutch tomatoes (in heated glasshouses) accounts for the largest share of the CO₂ they emit, transport emissions are still a fairly hefty 150g of CO₂ per kilogram. Even indigenously grown Swedish tomatoes produce 68g CO₂ per kilogram during the transport stage – equivalent to a quarter of the 300g emitted in transporting Spanish tomatoes. From a policy-making perspective, therefore, one might conclude that although the main focus of any energy reduction work should be on the agricultural stage, impacts elsewhere should not be ignored.

Other variables to consider

From a policy perspective it is also important to consider the total quantities eaten of each food from each source. Going back to the carrots, it is clear that while Italian carrots are far more energy-intensive than indigenously grown Swedish ones, the overall impact of the Swedish carrot industry is, in absolute terms, greater since Swedish people eat more Swedish carrots than they do Italian ones. While a small number of

foods may produce disproportionate quantities of CO₂, our 'bread and butter' foods, which are more likely to be grown indigenously, contribute to a large part of the emissions. We might thus need to consider not just how to persuade people to eat fewer energy-intensive imports but also what measures would help reduce emissions from mainstream foods.

It is also important to consider the 'solvability' of a certain impact. At present the UK's specialist glasshouse horticulture sector is the highest agricultural energy user, with energy accounting for around 55% of its variable costs.³¹² However, while this translates into a great deal of CO₂, there is also significant scope within the sector for the application of cleaner and renewable energy technologies. Indeed, we are already seeing small-scale adoption of renewable and combined heat and power (CHP) systems in the horticulture industry. British Sugar, for example, makes use of waste heat, electricity and CO₂ from the sugar production process to grow tomatoes. Waste water (used for washing the sugar beet) irrigates the tomato plants.³¹³

It is at present easier to apply renewable technologies to stationary infrastructure such as greenhouses than it is to vehicles. And where these technologies are applied, production related emissions will decline. This may alter the carbon balance between indigenous and imported produce. Field-grown Mediterranean systems may still remain less energy-intensive than the renewables or CHP-based British systems. However, the combination of reduced production emissions and the shorter transport journeys which indigenous production systems entail may lead to lower overall CO₂ emissions from indigenous produce than their imported counterparts. Instead of a trade-off between transport and horticultural production, a carbon-reducing synergy is thus achieved. Of course, all will depend on the effectiveness of these cleaner technologies and the extent to which they are applied within the horticultural sector.

Finally, there is the question of organic production to consider when balancing life-cycle impacts. The foods sourced by East Anglia Food Links are for the most part organic. Studies suggest that organic systems use between 30–50% less energy³¹⁴ than their conventional counterparts per unit of output.^{315,316} This can

312 *Climate Change UK Programme*, Department for the Environment, Transport and Rural Affairs, 2000

313 Personal communication, British Sugar, 2002, and *British Sugar and the Environment* www.britishsugar.co.uk/bsweb/bsgroup/enviro.htm#Horticulture

314 This results from a lower use of direct inputs, such as farm machinery and of indirect ones, such as fertilisers and pesticides

315 *Energy Use in Organic Farming Systems*, ADAS Consulting for MAFF, Project OFO182, Department for the Environment, Food and Rural Affairs, London, 2001

316 *Harmonisation of Life-Cycle Assessment for Agriculture*, Final Report, *Concerted Action* AIR3-CT94-2028, European Commission, DGVI Agriculture, Brussels, 1997

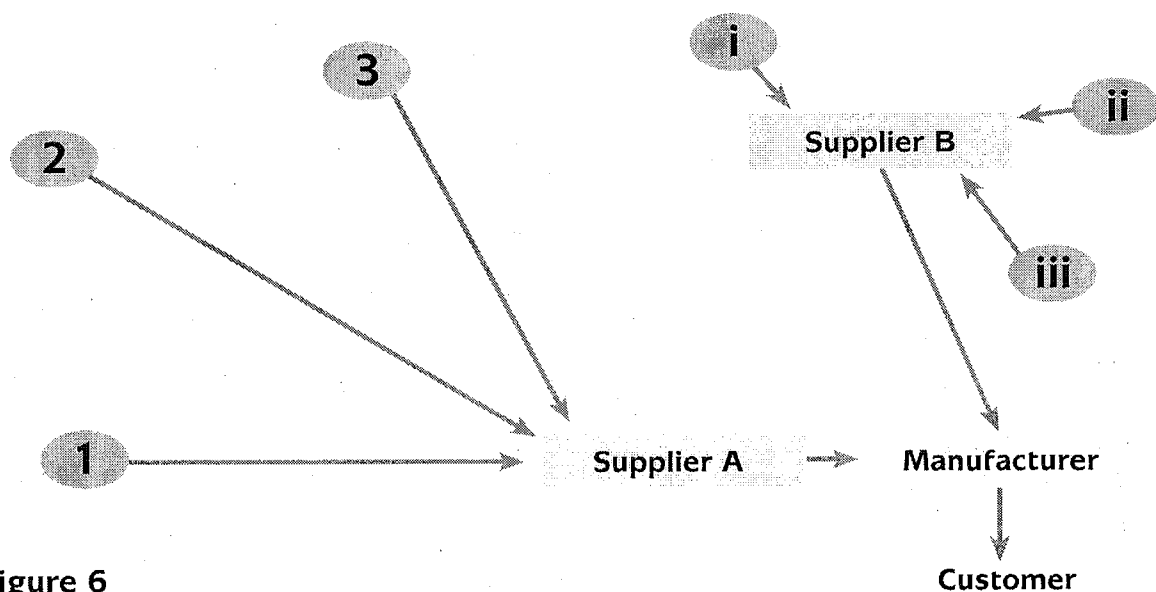


Figure 6

affect the balance between imports and indigenously produced food, depending on which is the organic system. The significance of this reduction will of course depend on the relative contribution that the actual growing process makes to total life-cycle carbon costs. The greenhouse gases produced by air-freighting organic produce will far outweigh the savings achieved, but when it comes to trucked produce the figures are likely to be more finely balanced.

So far we have explored whether efforts to shorten the supply chain might lead to increases in *non-transport-related* CO₂ emissions. However there is also the possibility that a shorter supply chain could in fact lead to an overall increase in *transport-related* emissions. This could come about if the 'local' supplier sources the primary raw ingredients from far away, while the ostensibly non-local supplier sources the primary raw ingredients from close to the place of manufacturing. Figure 6 illustrates this confusing possibility, with supplier B, the more distant supplier, being the most energy-efficient choice.

This is absolutely possible and it undoubtedly does occur, highlighting the importance of taking into account the source of the inputs to the end food product, something we were not able to do with our research.

This said, a three-year survey by the Foundation for Local Food Initiatives found that significantly more local food enterprises use local suppliers³¹⁷

than non-local enterprises – 75% compared with 50%.³¹⁸ They are also more likely to use local breeds and varieties, (18% compared with 10%), be involved in waste reduction (29% compared with less than half this figure) and either farm organically or be involved in some form of land management scheme. Again, this is a case of synergies rather than trade-offs between shorter supply chains and a reduction in environmental impacts elsewhere.

Of course these are small enterprises who are in a sense deliberately pioneering new ways of doing things for reasons which sometimes go beyond commercial incentives. There is nothing which dictates that a small or local business will be more environmentally aware. Nevertheless it may be that for small retailers, who are more interconnected with the local business community, it is in their commercial interest to source from nearer to home.

In addition to the possibility just described, it may also be that more locally focused systems still generate more transport emissions than more mainstream counterparts because they make use of smaller, less efficient vehicles. Heavy goods

³¹⁷ In this case they do not define what they mean by local

³¹⁸ *Flair Report 2003, Food and Agriculture Information Resource*, Foundation for Local Food Initiatives, Bristol, March 2003

vehicles are between five and eight times more efficient than vans per tonne carried.³¹⁹ We discuss this next, in the light of the third question: are local stores more or less transport intensive?

6.4 Local shops: How transport intensive are they?

The study into apples, cherries, and lettuces found that, for apples and cherries, the supply chain of the co-operative EAFL produced fewer transport emissions than those of the supermarkets. This was because for apples EAFL sourced from within the UK far more, and for more of the year, than the supermarkets. For cherries, EAFL sourced from Europe rather than, in the case of the multiples, from the US or Turkey. In addition, EAFL offered cherries to its customers only for a short season.

For lettuces however, the supermarket supply chains produced fewer transport emissions than EAFL's. This remained the case even when hypothetical improvements to the latter were modelled. There were various reasons for this, some logistical and others to do with trading relationships. For a start, EAFL's Italian supplier is further away than the supermarket's Spanish suppliers. EAFL sources from this supplier because it shares EAFL's commitment to the principles of co-operation and organic production. It is, however, looking to make links with a French co-operative which, if successful could reduce the distance greatly.³²⁰

Another reason for EAFL's higher emissions was because the route within the UK, both for imported and indigenous lettuce, was more circuitous and less efficient.

A third reason was because EAFL's local (as opposed to imported) lettuce supplies are carried in relatively small and therefore less efficient (per tonne-kilometre) vehicles. This said, the far shorter local distances entailed will have compensated for this to some degree, so it is really the first two factors which are the most significant.

The second study that the *Wise Moves* commissioned, into cheese, chicken and bread, looked at the differences between local shops and supermarkets, examining both their distribution systems and the way customers travel to buy their food. For this second study it should be emphasised that by 'distribution systems' the consultants mean the distribution of the retailer's best-selling product line from the manufacturer to each of the shops. Some of those goods were locally produced, while others were not. While some of the local shops studied source certain products directly from the manufacturer, often they do not, buying in from an intermediary wholesaler instead. This wholesaler may operate depots around the country.

Furthermore, the consultants do not assess the transport emissions from the inputs to the manufacturing process – the transport of milk for the cheese or of feed for the cows. Nor, when modelling more local sourcing options, do they model what CO₂ differences might result from localising the inputs (milk, feed for cows). What they examined was different sources of the finished cheese and the CO₂ emissions associated with transporting those finished cheeses to different types of store and then on to the customer's home. Finally, the consultants looked at only one of each of the multiples' stores. As such they did not consider what effect an alteration in the store's distribution strategy might have on the logistical arrangements of the other stores in the region that are served by the same RDC or RDCs. This is an important point and one which a future study should address.

Notwithstanding these limitations, their research revealed very interesting results, which varied widely both by product and by type of retailer. Generally speaking the smaller shops perform less well on greenhouse gas emissions when compared to the larger supermarkets, measured in terms of mass of CO₂ per mass of product. This is largely because smaller shops use smaller, less efficient delivery vehicles than the supermarkets and have less well integrated supply chains. Hence, when the consultants ranked each of the shops by CO₂ (for the logistics leg from manufacturer to store) a local shop ranked worst on each list. There was however considerable variability among the seven local stores, since the rankings also placed a local

319 Mason R, Peckham C, Simons D and Wakeman T, *Wise Moves Modelling Report*, commissioned by the *Wise Moves* project, Transport 2000, June 2002

320 Peckham C, East Anglia Food Links, personal communication, July 2002

Table 6 Shops ranked by CO₂ emissions from logistics for the three products


CO ₂ emissions	Ranking	Cheese	Chicken	Bread
	1	Shop D	Marks & Spencer	Shop G
	2	Booths	Booths	Shop A
	3	Shop C	Safeway	Marks & Spencer
	4	Safeway	Shop C	Shop E
	5	Marks & Spencer	Shop F	Safeway
	6	Shop B	Shop B	Shop D
	7	Shop A		Shop C
	8			Booths
	9			Shop F
	10			Shop B
Worst performing				

Table adapted from *Ecologica modelling work study*

shop at the best performing level both for bread and for cheese. Marks & Spencer's transport system produced the fewest CO₂ emissions per unit of product for chicken.

These rankings reveal that supermarkets have, on the whole, more efficient supply chains than local shops.³²¹ This conclusion reflects the time, money and expertise they have invested in efficiently servicing a nationwide distribution of stores. Just as significantly, however, the rankings also suggest that there is some relationship between lower CO₂ emissions and shorter journey distance.

To illustrate, one local shop achieved the lowest CO₂ emissions of all stores for bread because it sources locally. It is also the case that, of the CO₂ generated while transporting cheese from the manufacturer to one of the local shops, 63% of this CO₂ was emitted during the journey from the manufacturer to a wholesaler's RDC in Preston. This suggests that omitting this leg and sourcing more directly might change these results markedly. This will however depend on whether the load was consolidated, and with what.

Balancing distribution efficiency with journey distance

How important is distributional efficiency compared with overall journey distance? Of course, cutting kilometres from an efficient logistics system will be a good thing, provided it

remains efficient, just as will cutting it from an inefficient one. But does a fairly inefficient supply chain have to be very much shorter indeed for it to generate fewer emissions than a longer but more efficient co-ordinated system, or does even a little reduction in overall kilometres tip the balance in favour of the shorter trip?

Unfortunately, once again the answer is not simple. The graphs³²² overleaf plot CO₂ emissions per unit of product on a total journey basis for cheese and for chicken.

As shown in Table 7 (cheese), the general trend seems to be that the further cheese travels, the more CO₂ it produces. There are, however, anomalies. One supermarket transports its cheese for 470km but produces fewer emissions than a local shop where the distance travelled is only 300km (and this is without taking the complex variations in embodied energy into account). Table 8 (chicken), even more confusingly, shows no clear pattern whatsoever.

From this one might conclude that while in some cases the advantages of an efficient distribution system offset the disadvantages of greater distance, in all cases a short, efficient supply

³²¹ Although see discussion of empty running in section three

³²² Additionally supplied by Alastair Kirkbride of Ecologica and based on raw data gathered for the commissioned modelling work research, June 2003

Table 7 Cheese

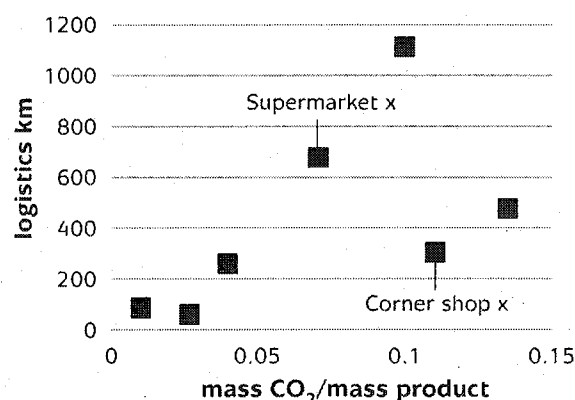
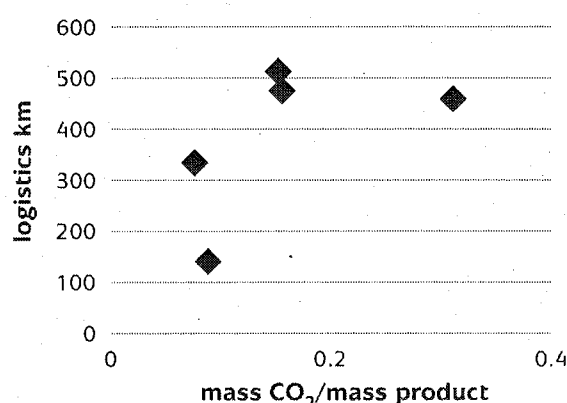


Table 8 Chicken



chain will be the best option. This however will not always be possible; local, relatively small-scale production can make it difficult to achieve full loads although 'milk-round' systems of the kind used in the automotive industry can improve efficiency. In addition the retailer will find it very difficult to accommodate the individual delivery systems of all its suppliers during a given 24-hour period, particularly given the loading and unloading restrictions that often operate.

For long distances, the efficiency factor has a different weight. The research into lettuce, cherries and apples compared what could be achieved simply by improving distributional efficiency (leaving the source unchanged) with what would happen following a change to a more local supply. One efficiency option they considered was improving two-way loading factors to 95%. This would mean ensuring that

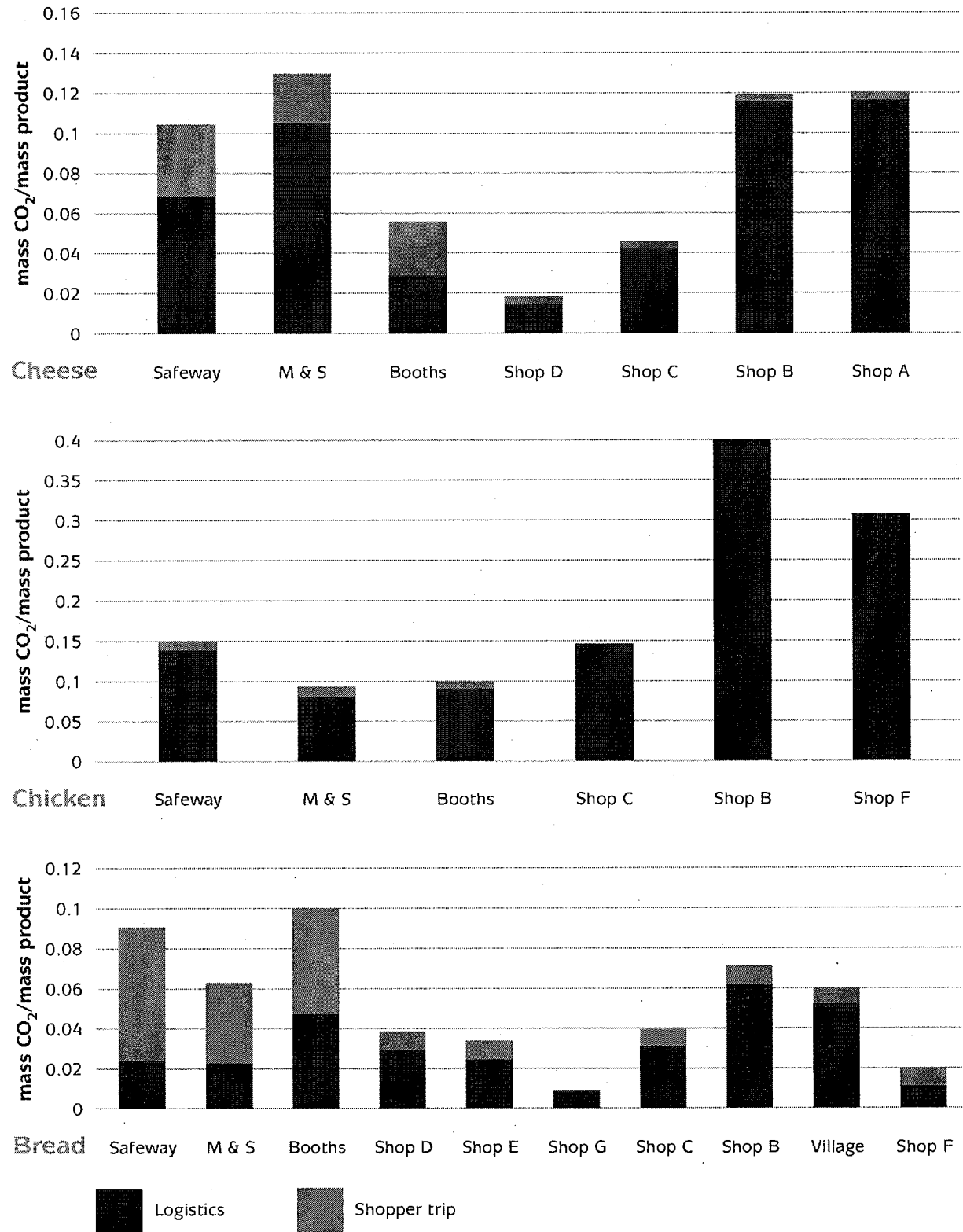
vehicles are more or less fully loaded both on the outbound and on the incoming journey. While this goal is probably unattainable, it serves as a way of gauging how significant such a measure could be relative to other measures. The consultants found that this improvement in the two-way load could cut transport CO₂ emissions by 6–12% for lettuces and 13% for apples³²³ but that for cherries the impact was negligible. If the two retailers were to share their distribution facilities, they could achieve additional savings of about 4% for lettuces and apples, but again, the effect on emissions from cherries would be minimal. Section seven discusses the scope and merits of shared systems in more detail.

This variation among products reflects the fact that for cherries the vast majority of transport emissions are produced overseas, or more accurately in the air. For lettuces and apples this is not the case. These are grown and sourced from the UK for some of the year, during which time all their associated transport emissions take place here. As a result the relative importance of making UK road haulage movements more efficient are greater. In addition, when lettuces and apples are imported, they tend to come in by ship or road. This, while polluting, is less so than flying them in. Hence the greater relative significance of UK-based freight movements and the greater the scope for cutting emissions through the distributional efficiency approach.

Moving away from distribution, another area of difference between local shops and supermarkets lies in the way customers travel to reach them. More people drive to supermarkets than to local stores. The growth in the multiples' local store formats may in future years affect this distinction but at present most people in the UK do a weekly planned supermarket shop, for which they use a car. The consultants studying the bread, cheese and chicken supply chains assume that 60–90% of people drive to the supermarket, depending on its location, while only 10% drive to local shops. The data sources upon which they base these assumptions are detailed in their report.³²⁴ They also state their assumptions as to how often the product is bought and what proportion it makes up of the total shopping basket, in order to calculate its share of the shopper journey, and thus its share of CO₂ emissions.

³²³ This figure is based on the fact that the vehicle will be loaded on the return journey, although obviously it will not be loaded with apples or cherries.

Figures 7, 8, 9 Mass of CO₂/mass of food product for the logistics and shopper trip components for each product and shop



Source: Ecologica modelling study

The significance of this modal difference among store types varies according to the product. For cheese (where supermarket logistics performance is roughly equal to the worst of the local shops and much worse than the best of them), the mode of shopper travel makes little difference to the overall ranking.

In the case of chicken, the supermarkets on the whole produce fewer emissions than local shops, even once the car-based shopping leg is taken into account.

For bread, the situation is different again. Without the shopper leg the supermarkets perform about average. However, once a car trip is taken into account, supermarkets do between five and eight times worse than local shops. This is because bread is a daily, perishable food and must be bought little and often.³²⁵ For the bread studied, the logistics element contributes relatively few emissions. The importance of shoppers' mode of travel relative to total transport emissions is therefore much greater.

Qualifying this statement, it is important to add that shoppers are unlikely to make dedicated trips to the supermarket just to buy bread. Most people will buy it once a week at the supermarket as part of their major shop and buy additional loaves from local stores for the remaining part of the week. Since bread bought at a supermarket is being purchased together with other products as a part of the planned weekly shop, supermarket bread's overall transport CO₂ emissions will be proportionately less than the figures just quoted, but still greater than if purchased from a local store.

For high embodied energy foods, or those which can be stored for a long time, there appears to be less advantage in shopping locally although this conclusion needs to sit clearly within the context of the ongoing wider discussions about local shops.

324 Ecologica, *Wise Moves Modelling Report: sourcing and distribution options for bread, cheese and chicken*, commissioned by the *Wise Moves* project, Transport 2000, June 2003

325 One can buy bread once a fortnight and freeze it but this adds to the emissions

326 This of course will require changes in people's behaviour – changes they may not be willing to make (see section seven for a fuller discussion)

For three sets of products alone the results are confusing and obviously it would be impossible to subject all foods to an analysis of this kind. However if a representative sample were looked at, some general principles might emerge. For instance it could be that for everyday perishables such as bread, milk or vegetables, walking to the local shop to buy them is a better approach than driving to the supermarkets,³²⁶ particularly if local shops' logistics operations were improved, and provided that shoppers do indeed walk, and not drive. There is however a large element of uncertainty as to how the distribution system might be affected if people were to buy more products from local shops; more research is needed here.

For staples or high embodied energy foods, such as meat, processed foods or rice (which is durable and bought in bulk) the local advantage is less evident. For other products still the shopper's mode of travel will tip the balance one way or the other.

6.5 Cooking

The kinds of foods we consume and how we prepare them also affect life-cycle CO₂ emissions. As highlighted in section four, fewer of us are now cooking from scratch, preferring ready-meals or partially-prepared foods such as pasta sauces.

The drive towards improving efficiency (in all areas) has had the effect of reducing the cost of food relative to total average household income. This has stimulated demand for now-affordable processed foods, leading to more consumption, more production of such foods and hence more overall use of resources, infrastructure and related mileage, up to the point where the food reaches the store. Of course there is only so much food one can eat but if pre-packaged, pre-processed foods are just as cheap as (or cheaper than) buying the unprocessed kind, then people will continue to consume more of them, relative to their consumption of less-processed foods, as well as yet more elaborately processed versions of the same foods.

These trends will affect the overall balance of emissions in the food supply chain. Some have argued that more processed food will lead to fewer overall CO₂ emissions within the food

supply chain, while others argue quite the reverse. The discussion here offers no conclusions but we feel it is important to articulate the debate, thereby, we hope, stimulating further research in this area.

The food industry points out that processed food – a lasagne, for instance – will have been baked in large batches in efficient commercial ovens, in contrast with inefficient domestic ones. Waste peelings and off-cuts will have been kept to a minimum and may even be used in the production of other foods or for animal feed (although discussion with industry suggests that this is not always the case). Packaging – which may appear very visible to the untrained eye – will in fact be no more than what is required to prevent the food from being spoiled in transit and may in fact represent less waste than the packaging surrounding the component ingredients of a home-cooked lasagne – the pasta box, the tray for transporting tomatoes, the plastic wrapper surrounding the cheese, the milk carton and so forth. Moreover those little rectangles of ready-made product will be easily stackable and hence enable vehicles to be filled to their maximum capacity. Only food that is eaten will be transported – energy will not be expended in carrying bits of vegetable that end up as peelings, and which are thrown away, themselves needing to be transported to landfill. Finally, heating up a microwaveable ready-meal uses very little domestic energy.

On the other hand, critics might argue that 'home' cooks often make enough lasagne to feed a whole family and still leave enough for dinner the next day, with leftovers reheated in the microwave. This domestic 'efficiency of scale' is in contrast with the portion-controlled sizes of ready-made meals: since people's appetites vary, for some a portion of ready-made lasagne will be too much (and the remainder may be thrown away) while others will still be hungry and will need to eat something else as well, something embodying additional packaging, processing and so forth. With home-cooked food it is easier to have second helpings of what is already cooked and available.

It may also be that a direct comparison between a particular processed product and its home-made equivalent will not always be valid. Ready-meals and processed foods are often more elaborate

and complex than those we would normally cook, hence their appeal. We eat ready-made pesto sauce because it is convenient; if it disappeared from our shelves, most of us would not pound away with pestles and mortars instead. While a regular consumer of ready-meals may eat lasagne one night and Thai curry the next, it does not follow that we should necessarily compare emissions arising from these foods with those cooked domestically. A person who cooks from scratch may eat more simply, making meals that require fewer ingredients and which do not always require an oven or 20 different ingredients.

Hence the growth in demand for processed foods creates new expectations of what constitutes everyday eating, and stimulates the development of products whose very existence depends on being trucked and flown about for various stages of assembly, processing and packaging. In addition, while a processed meal may ultimately generate less food waste, it may not follow that a reduction in waste automatically leads to environmental improvements. Arguably less waste means that more food gets through more efficiently, using less transport; this means that the price to consumers will be lowered, which in turn leads to more demand for yet more complex (and hence transport-intensive) products. And so on and so forth.

Finally, there are also the second-order impacts to consider. By no means all (or even many) cooks know or care much about climate change. However some have argued that knowledge and enjoyment of food and cooking may play an important part in educating consumers about environmental issues, and about their personal contribution to the problem of climate change. Food is, after all, the part of the planet that we eat. Those who cannot cook and know little about food production are psychologically remote from the environment that sustains their existence, just as climate change is forcing us to acknowledge our dependence upon it.

As with all life-cycle analyses, the conclusions will depend on the data used and the assumptions made, as we have already discussed. Moreover, the fact remains that whether people choose to buy ready-made food or to cook from scratch, they will waste both energy and other resources if they are interested in saving neither.

Given the uncertainty, we suggest that one helpful approach might be to compare the eating patterns of a spectrum of people who eat processed foods regularly with those who do not, averaged over a period of time. This way we would gain a clearer understanding of the variation between cooking and non-cooking households in the foods eaten, in preparation methods and in the treatment of leftovers; and on that basis develop a clearer understanding of the energy impacts of both approaches.

6.6 Conclusions

This section explored three questions: the importance of transport relative to other life-cycle stages, the effect on overall CO₂ emissions following a reduction in transport distance and the performance of supermarkets compared with local stores. It also discussed the uncertainties regarding the relative impacts of home-cooked versus ready-made food and highlighted the need for further research in this area.

Food transport's contribution to food-related CO₂ emissions is small but significant, especially for some foods and particularly as food transport emissions continue to grow. A small percentage of a lot is still a lot and 3.5% of total UK generated CO₂ emissions³²⁷ is a very great deal. This figure does not include unquantified emissions generated while transporting foods from overseas. These do not appear in any UK government data and are likely to be highly significant and on the increase.

This said, CO₂ emissions from other life-cycle stages will, at least when it comes to UK-produced foods, often be greater than those from transport. Agricultural production, food processing and refrigeration can all generate very significant impacts. The focus should very clearly be on achieving a lower carbon food chain, not on prioritising emission reductions in one area at the expense of others. We need to take action to reduce greenhouse gas emissions at all stages in the supply chain.

There is a complex relationship between transport distance and other life-cycle emissions. One cannot simply balance transport, on the one

hand, against other life-cycle impacts on the other. Many hands will be needed; alter one life-cycle area and complex interactions will occur among all the others, some positive and others not.

Sometimes, action to shorten the supply chain can lead to increased CO₂ emissions elsewhere in the supply chain. For processed foods the efficiency of the manufacturing plant may carry more weight than its location. For fresh produce it may be less carbon-intensive to source unseasonal produce (or produce which cannot readily be grown in our climate) from abroad. In all cases however, the point beyond which other life-cycle advantages outweigh the transport disadvantages will depend on the specifics of the production process, the transport mode and other factors.

We also suggest that at times the growth in food transport can be a good benchmark of unsustainability in other areas. Longer supply chains can mean more time spent in refrigerated storage and more loss through spoilage, both of which increase CO₂ emissions. Shortening the supply chain can help reduce emissions in these areas.

Our analysis highlights the need to consider the solvability of various life-cycle problems. There may be more technological scope for 'greening' UK glasshouse horticulture or refrigerated storage through the use of renewable energy than for doing so with transport; there will thus be synergies between reductions in production stage and in transport emissions. We also touch upon the future downsides of overseas sourcing strategies which at present appear to make environmental sense.

It is also important to bear in mind that where it appears to be 'better' to source from far away, it may be preferable still not to source that product at all. The consumer issues this raises are discussed more fully in section seven.

From our analysis, then, we conclude that there appears to be some relationship between shorter supply chains and less transport CO₂, although the relationship is by no means simple and will depend on the product, what sort of distances are involved and the mode and logistical efficiency of transport. We suggest that the goal of an efficient sourcing and distribution system is to balance the following elements:

³²⁷ This includes the customer leg

- *Local clustering:* The inputs to the product must be situated near to the site of production. For processed foods, it is important that the constituent ingredients can be and are grown or produced near by.³²⁸ For livestock production a nearby source of (among other things) feed and fodder will be important. There are also downstream connections to consider – in the case of livestock this will be the location of the abattoir, the cutting rooms and so forth. Conflicts will arise between the goal of locating near upstream sources and downstream customers.
- *Journey distance:* The distance from point of production to point of retail to point of consumption should be minimised.
- *Logistical efficiency:* The fuel efficiency of a vehicle and the way it is managed and operated are very important. In addition loads must be consolidated and vehicles as full as possible while they are in use.

For brevity we will from now on use the term *shorter-plus supply chains*, to characterise supply chains which combine a focus on journey distance with these other essential factors. We also suggest that there is some correlation between *shorter-plus* supply chains and lower life-cycle CO₂ emissions. The relationship is, however, even more complex. To hold true, some or all of the following elements will also need to be in place:

- *Seasonal and indigenous:* Fresh produce grown during its natural growing season and well adapted to UK growing conditions will be less transport intensive and produce fewer overall CO₂ emissions than non-indigenous foods or those imported out of season.
- *Efficient manufacturing:* The processing plant needs to be efficiently operated and managed.
- *Minimal use of temperature controlled storage:* This should not, in the process, compromise safety standards or generate waste through spoilage.

Of course it will not be possible for all of these factors to be present all of the time. However, these three factors, in combination with the three elements which characterise a *shorter-plus* supply chain could provide useful goals to aim for.

In addition to the food miles question, this section examined the relative efficiency of local shops compared with supermarkets. From the supply chains of the products we examined, the evidence suggests that for a given set of equivalent foods, supermarket transport systems tend to be less carbon-intensive than local shops. The qualifications we have included in this statement are, however, critical.

For a start, it is very difficult to separate logistical efficiency (vehicle size, use, management and so forth) from journey distance. Where, in the case of the co-operative EAFL, an attempt was made to source on a more local basis – cherries from Southern Europe rather than California, apples mainly from the UK – the transport CO₂ emissions generated were *lower* than those of the supermarkets. These reductions reflect the fact that for these imported foods, the majority of transport CO₂ was emitted before the products even reached the UK. As a result, the question of UK-based efficiency was comparatively far less important than that of the total journey distance. With lettuce, however, where both EAFL and the supermarkets used a combination of indigenous and imported sources, the supermarkets' logistical advantage tipped the transport CO₂ balance in their favour.

In the case of the Ecologica study (bread, chicken and cheese), none of the stores examined made any special attempts to source the products locally. However all sourced from within the British Isles and hence for these shops the emissions produced were lower than for those examined in the first study. The supermarkets performed consistently above average (in terms of low CO₂ per unit of product) but there was much more variation in the performance of local stores, with some performing very well and some very badly. The reasons for this variation are complex. The local stores that ranked best in the list did so because they sourced from nearer to hand than the supermarkets.³²⁹ However, the performance of others who also sourced from relatively near by was undermined by their smaller vehicles, and other logistical

328 Although the producer of raw ingredients may also supply to other manufacturers, complicating the matter further

329 The focus here is on relative distances, not on deliberate local sourcing strategies

inefficiencies. With the smaller distances entailed in UK supply chains, the importance of efficient distribution is very clear, hence the supermarkets' good performance in this respect. From this one might conclude two things: first, that we should place greater emphasis on improving efficiency across all store formats; and second, that importing from overseas changes the scale of emission production significantly. In other words, for imported goods the major concern (in terms of transport CO₂ emissions) is the overseas leg of the journey rather than the efficiency of distribution within the UK.

The supermarkets' logistical advantage lessens somewhat once the shopper trip is taken into account, although only in the case of bread does the advantage swing in favour of local stores. We suggest that for perishable foods, including fresh produce, the advantages of shopping on foot at local stores (this can include multiple-owned local formats) may outweigh the disadvantages of greater logistical inefficiency.

Is there anything to suppose that local, independently owned shops are inherently predisposed to being less logistically efficient than supermarkets? Section three described how better fleet management can improve efficiency and achieve CO₂ reductions; these will apply whatever the size of distribution operation and regardless of the distance the goods travel. However, it is fair to say that it will be much harder to achieve co-ordinated, co-operative systems for the many small and disparate enterprises in the independent retail sector. This

underlines the importance of improving efficiency within the independent sector, perhaps based on greater collaboration between them and the multiples. Section seven discusses some options.

As regards the supermarkets, while centralisation has its advantages, it also poses considerable challenges when it comes to shortening the supply chain and adopting more seasonal approaches to retailing food. As we have already highlighted, brand consistency and the ability to offer a huge range of foods from across the world have been critical to the supermarkets' success and popularity. Sausages on sale in Glasgow may not, in a decentralised system, be the same as those sold in Slough. Strawberries may not be available in December. Applying this approach will require a fairly fundamental reappraisal of the supermarket's brand identity, together with substantial efforts to communicate its values in ways which win the public's approval.

Finally: however complex the solution, it is undeniable that there is a problem. We continue to internationalise our supply chains, and CO₂ emissions from transport continue to increase. Emissions from other parts of the food supply chain are also growing. A lower carbon food system is urgently needed. *Shorter-plus* supply chains, incorporating the other factors discussed, can play a part in achieving the required reductions across the whole of the food chain. In the next section we describe what policies might foster a lower carbon food system and, as part of that, shorter, seasonally-focused, efficient and integrated sourcing and distribution systems.

Section seven

A lower carbon food system: Exploring the alternatives and the policies for achieving them

The status quo is not sustainable. It is important to be very clear about this. The IPCC states that we need to achieve a 60–80% cut in human-generated greenhouse gas emissions.³³⁰ All sectors, including the food industry, will have to make a proportionate contribution to achieving this goal.

However, while deciding upon the least carbon-intensive ways of producing and distributing food may be difficult, we need to keep in sight the truth that the way we do things at the moment is not compatible with the lower carbon future that we urgently need to create. Despite the gains in efficiencies that have been achieved, the magnitude of the problem we face dwarfs them.

We need to consider alternative approaches. In our conclusions to the last section we suggested that the features of a lower carbon food system would include the following six elements:

- *Seasonal and indigenous:* Fresh produce grown during its natural growing season and well adapted to UK growing conditions will be less transport intensive and produce fewer overall CO₂ emissions than non-indigenous foods or those imported out of season.
- *Efficient manufacturing:* The processing plant needs to be efficiently operated and managed.
- *Minimal use of temperature controlled storage:* This should not, in the process, compromise safety standards or generate waste through spoilage.
- *Local clustering:* The inputs to the product in question must be situated near to the site of production. For processed foods, it is important that the constituent ingredients can be and are grown or produced nearby.³³¹ For livestock production a nearby source of (among other things) feed and fodder will be

important. There are also downstream connections to consider – in the case of livestock this will be the location of the abattoir, the cutting rooms and so forth.

- *Journey distance:* The distance from point of production to point of retail to point of consumption should be minimised.
- *Logistical efficiency:* The fuel efficiency of a vehicle and the way it is managed and operated are very important. In addition loads must be consolidated and vehicles as full as possible while they are in use.

These goals are challenging, particularly given the existing, not especially favourable socio-economic context described in sections four and five. This section sketches out what a lower carbon alternative might (in theory) look like and how it might differ from the system we have today. It then moves on to discuss what policies we might need in order to move in this direction.

Before doing so it is important to state that although the starting point for this report was transport, we have ended up concluding that transport, while very important, is certainly not the whole story. If the following paragraphs place more emphasis on the reduction of emissions from transport than on other life-cycle areas, this is because in order to arrive at our conclusion, we spent most of our time looking at this area. And as a transport organisation this is evidently the subject upon which we focus our attention. Further research needs to be undertaken into other life-cycle areas.

330 *First Assessment Report*, Intergovernmental Panel on Climate Change, Geneva, 1990

331 Although the producer of raw ingredients may also supply to other manufacturers, complicating the matter further

A lower carbon food system

This report suggests that a more regionally focused approach to sourcing and distribution can help foster a lower carbon food system. Such an approach would rely upon the development of an invigorated farming sector working with its regional manufacturing base to supply a regional population with much of the food it needs. Where supplies are not available from within the region, producers from elsewhere within the UK would largely be able to satisfy demand.

We would of course continue to import some foods, because they have come to be seen as essential and a part of our food culture or because there are benefits, in terms of carbon reduction, from so doing. A sustainable (as opposed to simply low carbon) food system will also have to balance carbon-reduction objectives against other wider social and environmental issues, such as support for developing countries through fair terms of trade. This, however, is beyond the remit of the report.

In our view, a regional approach offers more CO₂-reducing potential³³² than either globalised systems or very local ones. Section two has already highlighted some of the problems of globalised systems. As regards local ones, we feel that it will not always be possible to grow and produce a sufficient variety of foods locally in sufficient quantities to meet local needs. As a result, transport journeys from a number of different sources will be needed to meet demand, possibly leading to more transport mileage overall. It is also the case that for some manufacturing processes there are energy-efficiency gains to be had from scaling up operations. In addition, we would argue that from a transport perspective at least, a reduction in overseas imports is perhaps the most significant challenge we have to address and as such we should concentrate on this rather than on the final 30 miles or so. This said, there are some particularly fertile and agriculturally varied parts of the UK where a fairly local approach may well be both achievable and environmentally preferable.

Supporting the agricultural supply base would be an efficient and co-ordinated distribution system,

involving co-operation among suppliers and retailers throughout the supply chain. Supporting it too would be a technological infrastructure specifically geared towards reducing carbon emissions and based on renewable or cleaner energy sources. This would enable goods to be grown, manufactured and produced in ways that do not create the potential trade-offs highlighted elsewhere in the report. Information and Communication Technologies as well as intelligent transport systems (for brevity, all called ICT) would also provide decision-makers with information and other tools they need both to maximise distributional efficiencies and to make sourcing decisions based on carbon life-cycle analyses.

What about the developing world?

Action to foster regionally oriented supply chains need not, as some have argued, destroy trade opportunities for the developing world. We are certainly not advocating no trade at all. On the contrary, we advocate trade which combines positive socio-economic objectives with environmental ones, including the goal of minimising CO₂ emissions. We would recommend that the scope for investing in value-added, non-air freighted products with UK market appeal be researched, and investment be made in enabling developing world growers to make the switch from energy-intensive crops, such as horticultural products, to value-added, lower carbon alternatives. We would also recommend support for developing countries to produce and market foods for consumers within their own regions.

We also envisage a more diverse retail structure fostering different patterns of shopping and more seasonal approaches to eating.

This is a somewhat simplistic account of what would undoubtedly be a far more complex picture. It does however highlight the fact that a lower carbon food system is likely to look significantly different from the way things are right now.

To achieve a full 60–80% cut in food-related greenhouse gas emissions, we will need to make very substantial changes in our way of life. However some reductions are better than none at all – we can work towards this goal by making many small shifts in the right direction. Hence the measures we suggest below are not intended to

³³² Both as regards total life-cycle CO₂ reductions and those arising from transport

be absolutist. Some indeed build upon measures that are already in place. None of them will work in isolation; a combination of policies is needed. All should of course be placed in the wider context of a sustainable food agenda.

Getting there: The policy options

Achieving a lower carbon food system requires movement in the following direction:

- 1 A recognition that the food system needs to reduce the quantities of CO₂ it emits very considerably.
- 2 Policies and measures to reduce carbon emissions throughout the life-cycle of food so that trade-offs become synergies.
- 3 A stronger national and regional food base.
- 4 Measures to shift businesses away from long distance food transport and towards more nationally and regionally based sourcing.
- 5 Co-ordinated and co-operative methods of distributing goods both for the multiples and for local independent stores.
- 6 Information and Communication Technologies which assist the development of less carbon-intensive systems.
- 7 Different retail structures.
- 8 Changes in the way we consume.
- 9 Ongoing research.

7.1 The status quo is not sustainable

We have access to sources of the highest quality foods from across the world and, in relative terms, spend less on food than at any point in history. On the other hand:

- The food system generates over a fifth of the UK's CO₂ emissions.
- Food transport alone is responsible for 2.5% of the UK's total CO₂ emissions, or 3.5% if shopper travel is included.
- Supply chains are, on average, getting longer. In terms of greenhouse gases, much of the overseas leg of the journey is an uncounted

cost; and can be far greater than the emissions generated within the UK.

- Aviation is the fastest growing source of climate change. Growth in air freight is faster than growth in passenger air travel. Food is the largest air freight sector.
- In addition to climate change there are many other social and environmental problems associated with the ways in which we produce and distribute foods, some transport-related and some not.

7.2 An integrated low carbon food chain

Transport, while important, is just one consideration in the development of a low carbon food chain. As we have seen, the supply chain also generates often greater quantities of emissions during other stages in the food's life-cycle, such as in agricultural production, processing, storage and refrigeration, cooking, and waste disposal. Whatever the balance of emissions, however, action to reduce them needs to consider the supply chain as a whole.

Climate change policies, both international and national, aim to tackle emissions from the food and other sectors. This section discusses the effectiveness of policies first before examining more specifically what else government could be doing to reduce emissions from all areas of the food chain.

International agreements

For climate change, the most important international development in recent years has been the ratification by 180 countries of the Kyoto Protocol, the notable exceptions being the United States and Australia. The knock-on effects of the Treaty for the UK have been the development of various schemes to reduce carbon emissions from fossil fuels and to promote the use of renewables. At the end of 2001 the UK government set up the world's first economy-wide greenhouse gas emissions trading scheme. Nearly 900 organisations have now signed up to it and in so doing have agreed to reduce their emissions against 1998–2000 levels. An EU-wide emissions trading scheme is also likely to be launched in

2005 although transport is not included. When this scheme is introduced, it does have the potential to affect business energy use across Europe. However, the rate of change will depend on the number of pollution permits available.

In the UK, the Climate Change Levy (CCL) which came into effect in 2001 has a potentially important role to play in encouraging carbon reduction across the supply chain. All food businesses are subject to the levy. In addition the major food retailers, manufacturers and many smaller ones have now signed up to making targeted energy reductions in certain areas of their business in return for which they receive an 80% rebate on the CCL. For supermarkets, the eligible areas are their bakery and rotisserie operations; Safeway, for instance, has reduced emissions from these sources by 2% in the last year. Added to this, 1.48% of its energy now comes from renewable sources. Both measures, while small in themselves, may not have been achieved if it were not for the levy.³³³

However, the levy at present has a very limited effect on business operations, since most of the large businesses, at least, are able to swallow the cost without undue discomfort and carry on more or less as before. Government needs to consider ways of increasing the cost to business of producing CO₂ emissions while not, at the same

time, penalising them out of the country. The reduction by 0.3 percentage points³³⁴ in employees' National Insurance Contributions introduced in conjunction with the levy is an attempt at offering carrots as well as sticks. However, the relationship between the charge and the NIC reduction is for many businesses unclear.³³⁵ The thinking behind this relationship needs to be made more explicit. Increases in the cost of the levy as well as in the NIC reduction should also be considered.

It is unfortunate too that other aspects of energy policy, notably the New Electricity Trading Arrangement (NETA) which has brought down the cost of electricity, have run counter to measures to reduce energy consumption.³³⁶ A great many horticultural enterprises in the UK have access to a CHP facility.³³⁷ For most of these enterprises, however, the CHP option is simply not cost-effective. If we are to see a reduction in climate changing emissions from all sectors of the food industry, Government needs to take further action to ensure that its policies harmonise with, rather than work against, one another.

A number of other levies, taxes and incentives aimed at encouraging business to be more energy efficient have been set up. However, industry has found this assortment of initiatives somewhat confusing, and with reason.³³⁸ A clearer, simplified system of accessing information, grants and assistance will help.

Government also needs to develop many more measures that help small businesses reduce their carbon emissions. At present few of them have the resources or incentive to think strategically about their energy use.³³⁹ It is encouraging to see that the Environment Agency has recently produced an online guide to enable smaller food and drink businesses to navigate their way through environmental legislation.³³⁹ The Carbon Trust also provides information for small businesses. Ongoing measures to promote their use, however, will be essential.

February 2003 saw the publication of the Government's Energy White Paper.³⁴⁰ This White Paper signals government's intention to 'work towards' cutting emissions of CO₂ by 60% by 2050 in line with IPCC recommendations, and the Prime Minister is urging other EU nation states to do the same.³⁴¹

333 CSR Report, Safeway 2003, www.safeway.co.uk

334 Which is greater than a 0.3% reduction

335 *The Climate Change Levy: first year assessment*, Confederation of British Industries and Engineering Employers' Federation, London, November 2002 [www.cbi.org.uk/ndbs/PositionDoc.nsf/81e68789766d775d8025672a005601aa/e8fd76fd3a0f8eef80256c6800396f9b/\\$FILE/CCLbrief.pdf](http://www.cbi.org.uk/ndbs/PositionDoc.nsf/81e68789766d775d8025672a005601aa/e8fd76fd3a0f8eef80256c6800396f9b/$FILE/CCLbrief.pdf)

336 *Next Steps for Energy Taxation: a survey of business views*, Green Alliance, London, 2002

337 Horticultural Development Council, personal communication, August 2003

338 *Next Steps for Energy Taxation: a survey of business views*, Green Alliance, London, 2002

339 See: www.environment-agency.gov.uk/netregs/sectors/457023/?version=1&lang=_e

340 *Our Energy Future: creating a low carbon economy*, Department for Trade and Industry, London, February 2003

341 Letter from UK Prime Minister Tony Blair to Costas Simitis, Greek Prime Minister and President of the European Council, February 2003. www.number-10.gov.uk/output/Page3093.asp

A Sustainable Energy Policy Network (SEPN) has also been set up in the wake of the White Paper to ensure that the key elements of the energy strategy actually materialise. With workstreams focusing on, among other things, renewable energy, CHP and energy efficiency, there is much here that could aid the development of a lower carbon food chain. However, the relevance to the food industry is only implicit. There is in fact scarcely a mention of food in the White Paper despite the significant contribution the sector makes to climate change.

The SEPN, the food industry, government departments and public interest organisations need to sit down together to identify which of the 130 objectives articulated in the White Paper could apply to the food industry. They then need to develop a lower carbon action plan for the food industry as a whole, complete with easily accessible and well-disseminated information to encourage the uptake of grants and other opportunities by its members. In addition, Government needs to encourage greater clarity and transparency in company reporting on greenhouse gas emissions. At present it is difficult to make comparisons between different businesses. Such transparency will also enable progress to be assessed over time.

Government also needs to be bolder in its ambitions for the food industry. It could, for instance, issue a challenge or competition to all elements of the food industry, inviting players to achieve a 20% cut in the emissions they produce over ten years. Whether they achieve this by focusing on improving emissions from agriculture, from manufacturing or from logistics, would be up to them.

Achieving such a cut would require co-operation along the supply chain. It would also have the effect of substantially reducing emissions for the foods that the vast majority of people actually eat – *Mars Lites* as it were, for the masses. The educational and marketing potential of approaches such as these is discussed more fully below.

In addition there is private sector catering to consider, which is worth around £23 billion a year.^{342,343} By 2025, spending on food eaten out of the home, on take-aways, in pubs, restaurants, cafés and work canteens, could equal and begin

to overtake food retail sales.³⁴⁴ This sector is tremendously fragmented, spanning multinational chains, family-run sandwich bars and Michelin starred restaurants. Government could equally direct its low carbon challenge to the major catering chains.

7.3 A regional supply base

Greater regional availability of a more diverse range of raw and manufactured foods will require regional, national and European policies to support and strengthen regional farming and food manufacturing enterprises.

To an extent Government is starting to move in the right direction. Nevertheless there are still areas of serious weakness. However positive many of these developments have been, the support on offer is too little to counter the force of the trends heading in the opposite direction; towards globalisation, specialisation and sourcing from overseas. The danger is that a two-tiered agricultural system may emerge, with intensive food production overlaid by a greener, more environmentally benign but essentially Marie-Antoinette type of recreational farming; imported everyday foods supplemented with locally produced smoked salmon, as it were. Government needs to extend its policies beyond support for value-added niche products (which are also produced for export) to embrace the mainstream foods that we all need.

As a first step, Government needs to state far more explicitly than it currently does not only that carbon reduction is core to its agricultural vision but also *how* its policies will achieve the reductions that we all want to see. There appears to be little policy overlap between agricultural and energy policies.

342 *UK Foodservice Market Overview*, Fact Sheet, Institute of Grocery distribution, Letchmore Heath, 21 August 2002, www.igd.com

343 Its contribution to greenhouse gas emissions may be less than this figure suggests simply because the £23 billion will include a significant mark-up; the constituent ingredients are likely to be far smaller in quantity than the figure suggests

344 *Foodservice Sales to Equal Retail Food Sales by 2025*, news release, Institute of Grocery Distribution, Letchmore Heath, 4 January 2001, www.igd.com

There is, moreover, too little emphasis on the promotion of diverse and mixed farming systems – as opposed to farm ‘diversification’ into bed-and-breakfast accommodation. We need to see a greater emphasis on agricultural diversity (and not just at the smallholding level) if we are to regionalise our supply base, build up energy-efficient regional production and manufacturing, and reduce the transport of food across regional and national boundaries.

The Food Chain Centre (FCC) is, at present, a missed opportunity. Its focus is very much on efficiency and its remit lacks an explicit environmental dimension. Of course if it is successful in its goals of improving the competitiveness of British farming (hence enabling the substitution of some imports with British produce) and cutting down on waste, this focus could lead to transport emission reductions. However, the relationship between efficiency and overall reductions in CO₂ emissions is, as we have argued, not inevitable. Consequently we suggest that the FCC’s purpose needs redefining, with the meaning of ‘efficiency’ enlarged to include carbon efficiency.

One important area of concern is the severely under-supported horticultural sector. Government needs to provide more assistance for horticultural enterprises and to combine this support with investment in lower carbon technologies. This will minimise any potential trade-offs between transport and other life-cycle emissions.

Government also needs to tackle the scarcity of local and regional abattoirs, a shortfall which requires animals to travel over long distances before they are slaughtered. More than half of all abattoirs have closed over the last five years, principally because of a charging system which favours larger over smaller ones.

In addition, Government has recently introduced new requirements which will further increase costs for small slaughterhouses. Clearly, food

safety must be paramount but it has been argued that Government could offset the costs to small enterprises with rebates or other cost recovery mechanisms.³⁴⁵

The Animal By-Products Regulation, introduced in April 2003, requires all abattoirs to collect and store blood for later disposal. As well as the expense, disposal by this means would mean substantially increased long distance lorry journeys. The Country Land and Business Association, National Federation of Women’s Institutes, Soil Association and other partner organisations are urging DEFRA to request a permanent derogation for smaller abattoirs.³⁴⁵

In addition to this derogation, government could require supermarkets to use a broader selection of suitable abattoirs instead of, as they do, contracting to only one or two abattoirs each for the whole of the UK.³⁴⁵ Such measures are justifiable not just from a transport reduction perspective but also to reduce the suffering that live animals undergo on their way to slaughter.³⁴⁶ We also need to see more support for the development of infrastructure such as cutting rooms, processing plants and packhouses, situated near to the point of slaughter. In many cases such developments will not require the construction of new facilities but rather changes in the use of existing slaughterhouses. At present not all slaughterhouses have such facilities and as a result, whole carcasses need to be transported for cutting and further processing.

At the regional level, while many of the RDAs have undertaken a high-level analysis of the food chain in their region, there is a need for much more specific research into food needs and food availability. This should be based not only on what is eaten now but on what might be eaten in a few years time, and should also take into account other government and regional policies, including those aimed at increasing fruit and vegetable consumption. Below, we explore how such analysis could help the development of Internet-based technologies that enable suppliers and purchasers to make lower carbon decisions.

Much of the work we need to see places emphasis on the importance of communicating to all elements of the food industry what is going on, what grants and other forms of support are available, encouraging the uptake of new schemes

345 Soil Association, personal communication, July 2003

346 While it is arguable that it may be easier to supervise the animal welfare standards of just a few, large and efficiently run operations, equally an inspector may be able to check up on, and gain an impression of a smaller set-up relatively quickly. The point is to ensure that the standards and monitoring procedures in place are rigorous, otherwise they will be open to abuse whatever the size of the operation

and providing support, such as IT training, to deal with the inevitable paperwork that is involved. This will not be an easy task and it remains to be seen how the English Food & Farming Partnership (EFFP), set up to do just this, approaches the problem. We would also hope to see the EFFP promoting collaboration to achieve CO₂ reduction as well as economic objectives.

The point is frequently raised that action by government to promote British or regional farming contravenes State Aid regulations. These regulations certainly do present obstacles. For instance EU Public Procurement regulations prevent discrimination against a supplier on the grounds of location or nationality. While allowing external economic costs incurred by the purchasing authority to be taken into account in the award of contracts, they do not allow the external economic costs incurred by the purchasing authority's *community or society at large* to be considered.³⁴⁷

Many have, however pointed out there are ways of promoting regional foods within the context of these regulations, France and Italy have been particularly successful in this respect. As Sir Donald Curry points out³⁴⁸ it is possible, although not easy, to develop procurement contracts which in effect require food to be sourced on a national or regional, rather than an international basis. Approaches include specifying that the food must be of a certain quality or degree of freshness, or meet certain environmental requirements. Government has taken welcome steps to promote sustainable procurement within current EU restrictions, as we discuss below.

Evidently however, the situation is far from ideal and government has a role to play in campaigning for the inclusion of environmental and social criteria in purchasing regulations both at an EU and an international level. There are also opportunities for using other structural funds, rural development programmes and so forth more carefully.

As an additional approach, there is also the Appellation Contrôlée or Protected Status foods designation to consider; the kind that only allows ham produced in Parma to be called Parma ham. At the September 2003 WTO talks in Cancun, the EU presented a list of 41 products that in its view require protected status.³⁴⁹ While no agreement

was reached, the EU Commissioner Franz Fischler has stated that these proposals will remain on the table for future talks. The impact of such a designation is uncertain. On the one hand, Protected Status may promote regionally specific food, and by increasing awareness of (and liking for) such foods within the home region, help protect against imported variants³⁵⁰. On the other, it could lead to increased food transport as consumers seek authentic speciality foods from overseas. A decision to grant protected status to feta cheese³⁵¹ means that a Yorkshire producer of a feta-like cheese is now no longer able to call it by that name. While this may not put off regular customers, it may mean that new customers go for the imported feta as a first choice, leading to more food transport. The impacts of Protected Status accreditation need to be considered in more detail.

Moving on from UK and European policies, we also need to see profound changes at the international level. The recent landmark CAP agreement reached at the Luxembourg Agriculture Council meeting in June 2003 is a welcome step in the right direction as it 'decouples' or breaks the link between subsidies and production, enabling funds to be diverted towards less environmentally damaging forms of production. However, a £30 billion a year subsidy structure still remains and many development organisations are still concerned that export dumping will continue to damage developing world farmers.^{352,353} This dumping represents unnecessary transport and unnecessary transport emissions.

The WTO talks in Cancun in September 2003 presented an opportunity for the UK government

347 *Sustainable Food Chains, Briefing 2 Public Sector Catering: opportunities and issues relating to sustainable food procurement*, Sustain, London, 2002

348 Quoted in *The Grocer*, William Reed Publishing, West Sussex, 11 January 2003

349 *EU Set to Fight over GIs*, Food & Drink Europe, 29 August 2003, www.foodanddrinkeurope.com/news/news.asp?id=2723

350 *Strategy for Support for Regional Food*, Department for the Environment and Rural Affairs, 17 July 2003, www.defra.gov.uk/foodrin/foodname/news2000.htm

351 *Europe Rules on Yorkshire Feta*, BBC North Yorkshire News, 13 September 2002, www.bbc.co.uk/northyorkshire/news/2002/09/13/cheese.shtml

352 *CAFOD Slams CAP Reform for Failing the Third World*, news release, CAFOD, London, 26 June 2003

353 *EU CAP Reforms a Disaster for the Poor*, news release, Oxfam, Oxford, 26 June 2003

to press for an end to dumping on developing world countries and to work towards achieving a more environmentally focused global agriculture. The process largely failed and there was minimal discussion of environmental issues. A strengthened developing country lobby did, however, emerge from the ashes and it remains to be seen what happens next.

7.4 Measures to curb long distance food transport

If Government is serious about meeting its climate change obligations it will need to adopt a far more robust approach to transport than is the case right now.

It needs to put in place a policy structure which optimises freight movements, encourages shorter supply chains and which abandons its current plans to build its way out of our transport crisis.^{354,355}

This discussion start with the most polluting form of transport, aviation. Most policy makers, including the UK Government,³⁵⁶ the EU³⁵⁷ and the International Civil Aviation Organisation (ICAO)³⁵⁸ now recognise that an increase in the cost of aviation is necessary and are considering – some more vigorously than others – the options. In addition, a number of bodies, including the Aviation Environment Federation,³⁵⁹ Transport 2000,³⁶⁰ the Institute for Public Policy Research³⁶¹ and the Royal Commission on Environmental Pollution³⁶² have put forward proposals for change. We summarise some of the options in the box opposite.

354 *Massive Roads Expansion for the UK*, BBC News, 9 July 2003 <http://news.bbc.co.uk/1/hi/uk/3056636.stm>

355 *£7 billion Blitz on Britain's Most Congested Roads*, news release, DfT, 9 July 2003

356 *Aviation and the Environment: using economic instruments*, DfT, 2003

357 *Air Transport and the Environment*, European Commission, Brussels, http://europa.eu.int/comm/transport/air/environment/index_en.htm

358 International Civil Aviation Organisation www.icao.int/cgi/goto_atb.pl?icao/en/env/aee.htm;env

359 Sewill B, *The Hidden Cost of Flying*, Aviation Environment Federation, London 2003

360 Whitelegg J and Williams N, *The Plane Truth: aviation and the environment*, Transport 2000 Trust and Ashden Trust, London, 2001

Aviation: The policy options

The first, most immediately obvious approach would be to tax aviation fuel. Such a tax has been seen to be long overdue.³⁵⁹ Imposing it, however, raises a number of difficulties. The international aviation industry is against such a move and has strong backing from the US and many developing world countries (particularly the Far East) who see such a tax as a threat to their tourism and export industries. Some have argued that its imposition unilaterally could undermine the competitiveness of British airlines, and while an EU tax would create a level playing field within Europe the disadvantage would manifest itself in competition at the global level. Moreover, were global agreement to be reached world wide, imposing the tax would require the dismantling of over 2000 bilateral air-service agreements.

The UK Treasury has moreover argued that a tax would not have a very strong effect. According to its calculations, a 100% increase in the cost of kerosene would only reduce demand by about 10%.³⁶³ Others have pointed out that this does not necessarily constitute an argument for not taxing aviation fuel but rather for taxing it more highly or taxing in other ways as well. A 300% increase in fuel costs (amounting to about 54p a litre) would put the cost of aviation fuel more on a par with (but still lower than) truck diesel which costs around 62–65p a litre before VAT.³⁵⁹

One option proposed³⁵⁹ is a 'fair tax package' for the UK. This, combining a tax on aviation fuel with the imposition of VAT and the abandonment of duty free, could help contain growth to within the capacity of UK airports. It would allow for a slight increase in demand, with this offset by those efficiency gains which the RCEP feels to be realistic, meaning that the aviation industry keeps to today's level of emissions.

A second approach³⁵⁹ might be to auction slots. Airlines would bid for the right to land and take off at airports, the idea being that there would be (preferably declining) limits on the amount of slots available – a winged version of musical chairs. This could have a similar effect to the fair tax package. It would need to be combined with restrictions on airport development to encourage greater competition for, and raise the implicit price of, the available take-off and landing slots.³⁶⁰

A third alternative, and the one most favoured by ICAO, is open emissions trading.³⁶⁴ The total amount of allowable emissions would be capped and permits to emit CO₂ could be then bought and sold to meet emission reduction objectives.³⁶⁵ As an open system, the aviation industry would be able to buy permits from other industrial sectors. While this could work, the risk is that airlines will simply buy permits from elsewhere and carry on growing, and polluting, more or less as before.

Emissions *charging* is the fourth option, and one which appears to be most likely to go ahead, with the UK Government and most environmental groups also in support provided the charging scheme goes hand in hand with policies to ensure that industry cannot buy its way out of the problem. Charging, rather than a fuel tax, would be more acceptable to industry too and would have the reasonable effect of penalising the generation of emissions, rather than the source of those emissions. Both the EU³⁶⁶ and the UK Government³⁶⁷ have commissioned research to establish what a fair price for emissions charging might be. While such research has signalled a step towards action, environmental groups have argued that the reports do not take into account the full climate changing costs of aviation, in so far as a cost can ever be established.³⁶⁸ If imposed, estimates suggest the charge would reduce demand by about 7% and emissions by around 5%. As freight operates to lower profit margins and is therefore more cost-sensitive than passenger travel, we may see much of the cut in demand coming from the freight industry.

Underpinning any form of aviation charge however, is the need for Government to abandon its proposals for airport expansion. It is very difficult to see how sustainable aviation objectives can be achieved if the infrastructure available to the airline industry is allowed to expand so significantly.

Indeed, the Environmental Audit Committee had this to say about Government policies: '*The Secretary of State for Transport appears to have his own agenda. He has recently dismissed the Royal Commission's report on aviation as superficial. He also dismissed the possibility of fiscal measures to take account of the environmental costs of aviation, and indeed his reported comments suggest that he has set himself against any rise in air fares.*'³⁶⁹

Government's aviation and international development policies highlight a major flaw in its approach to greenhouse gas reduction – the fact that it does little to consider the environmental impact of its overseas activities. This is because official methods of measuring national greenhouse gas emissions do not include emissions generated by the UK 'off shore.' Hence there is little or no focus by policy makers on discouraging food and feed imports. Indeed, while the introduction of measures which have the effect of increasing regional sourcing might lead to absolute reductions in greenhouse gas emissions,³⁷⁰ what might show up on the UK greenhouse gas balance sheet is an apparent increase in emissions. This is because CO₂ emissions generated by overseas food production and transport are not included.

For aviation, there are, however, steps that government can take independently of Europe or the international community which will also have the effect of reducing those UK emissions that do presently 'count.' It can for instance introduce charges for domestic flights. While this will not affect food (which does not travel internally by

361 Bishop S and Grayling T, *The Sky's the Limit: policies for sustainable aviation*, Institute for Public Policy Research, London, 2003

362 *The Environmental Effects of Civil Aircraft in Flight*, Royal Commission on Environmental Pollution, London, November 2002

363 *Air Traffic Forecasts 2000*, Department for the Environment, Transport and the Regions, London, 2000

364 International Civil Aviation Organisation, www.icao.int/cgi/goto_atb.pl?icao/en/env/aee.htm;env

365 *Aircraft Engine Emissions*, International Civil Aviation Organisation, www.icao.int/icao/en/env/aee.htm

366 Dings J, *External Costs of Aviation*, CE, Delft, 2002 www.aef.org.uk/PDFs/CE%20external%20costs%20of%20aviation.pdf

367 *Aviation and the Environment: using economic instruments*, HM Treasury and Department for Transport, London, 2003

368 Johnson T, Aviation Environment Federation, personal communication, 2003

369 *Pre-Budget Report 2002: tax and the environment*, Fourth Report, Environmental Audit Committee, London, 2002, www.parliament.the-stationery-office.co.uk/pa/cm200203/cmselect/cmenvaud/167/16703.htm#a10

370 And other emissions, provided measures are put in place to achieve CO₂ reductions throughout the product's life-cycle.

air) it can help establish the charging principle and, by setting an example, may hasten the development of an international system.

As regards land transport, Government appears set to embark upon a new phase of road building.³⁷¹ Many NGOs have argued that the consequences of this will be highly damaging³⁷² as, among other things, it directly undermines attempts at managing demand, reducing unnecessary transport movements and promoting efficiency. More roads will, at least in the short term, lead to easier and quicker journeys. The consequences will be lower transport costs to business and less of an incentive to minimise unnecessary movements.

The introduction of a lorry charge in 2006 could, in principle, provide a counter-weight to Government's road building policies. This charge will replace other existing ones, such as Vehicle Excise Duty. It will affect different types of journeys in different ways and will lead to some journeys costing more than they do at present. Others will cost less. Overall however, the charge will be revenue neutral. At the time of writing neither the detail of the scheme nor the modelling assumptions underlying the charge were publicly available and as such it is difficult to assess what, if any, effect it will have on transport movements or carbon emissions.

Once the principle of the charge has been established, there may be scope for varying the charges, depending on lorry weight, axle structure and vehicle emissions, or by road type or time of day and this variation could lead to some overall reductions in CO₂ within the freight sector.

For real changes to flow from the new charge, however, we would need to see significant increases in the cost structures. Since the charge will be accompanied by a drop in the price of fuel (possibly down to the EU minimum) this increase would have to be fairly considerable if it is to encourage business either to adopt further fuel efficiency measures or to rethink the distances their fleets travel. Given Government's willingness to abandon the fuel duty escalator a few years ago in the face of industry and public pressure, it is hard to believe that the pricing structure for the charging scheme will be especially hard hitting.

What is clear is that over time the charge needs to be increased quite considerably for it more accurately to reflect the costs that lorries impose. Food freight transport's contribution to UK CO₂ emissions stand at around 2.5%. The cost of transport relative to the end price of food is just over 1%.³⁷³ The market is clearly not ensuring that the cost of food transport is in keeping with the relative contribution it makes to the UK's greenhouse gas balance. To ensure that food transport pays its way even within existing cost structures (which do not reflect the true cost of greenhouse gas emissions to society) we would need to see the cost of transport at least double.

We should emphasise, however, that economic signals (based on assigning CO₂ emissions a cost) will only go so far. Since transport is such a small percentage of overall costs³⁷³ (although it may be greater for air) even a hefty price increase will only have a limited effect on total supply chain costs.

A US study on paper production, which examined the relationship between paper production, paper transport and various taxation options found that a fuel tax which raised the cost of transport by around 5% led to a mere 0.3% reduction in energy use within the paper life-cycle as a whole.³⁷⁴ This partly reflects the fact that transport only accounts for one element of total supply chain emissions. It also suggests that, with transport accounting for only a small proportion of the total product cost, even relatively large tax increases will have a limited effect on transport demand.

In addition, a report³⁷⁵ which examined the effect of fuel price changes on motorists' behaviour found that a 10% price increase leads to a 6–8% decrease in fuel consumption over the long term.

371 *£7 Billion Blitz on Britain's Most Congested Roads*, news release, Department for Transport, 9 July 2003

372 *Transport 2000 Reacts Angrily to 'Roads Binge'*, news release, Transport 2000, London, 10 December 2002

373 *UK Retail Logistics Overview*, Factsheet, Institute of Grocery Distribution, Letchmore Heath, 2003

374 Vanek F, *The Transportation-Production Trade-Off in Regional Environmental Impact of Industrial Systems: a case study in the paper sector*, *Environment and Planning A* (2000), 32:5, 817–32, Pion Ltd, London, 2000

375 Glaister S and Graham D, *The Effect of Fuel Prices on Motorists*, AA Motoring Policy Unit and United Kingdom Petroleum Industry Association, Basingstoke, September 2000

For freight, it is probable that demand would be rather less elastic and so the reductions would be correspondingly lower.

This is not an argument for not charging. On the contrary, it is an argument for raising charges quite considerably and we would recommend just such a measure. But there is only so far that fiscal measures can go; a charging structure which reflected the 'true' costs of climate change but which allowed polluters to carry on emitting unsustainable quantities of CO₂ would not suffice. We also need to develop policies that in effect place absolute limits on food transport emissions, as well as on emissions from other sectors. Government and other players need to consider how this objective might best be achieved within the context of a free market economy.

Most important, for food, we need to see transport policies introduced in combination with other non-transport-related policies, including those which raise the cost of energy use in other life-cycle areas. The integration of these measures is critical, both to help industry move in the right direction and to offset the financial burdens that arise, by compensating in other areas.

7.5 Different distribution structures

There is a risk that the regionally focused system we propose may at times mean the transport of smaller quantities of goods and as such, a loss of efficiency. The challenge will be to work out when the benefits of short distance outweigh the disadvantages of inefficient vehicles and when they do not. Efforts will also need to be made to minimise inefficiencies and we discuss a few possible approaches here.

One approach is for retailers to share infrastructure; this will mean the collective use both of distribution facilities and of vehicles. Although the study into lettuces, apples and cherries found shared networks could deliver only modest savings, their model was based upon co-operation between just the two retailers. The more companies involved in the shared network, the greater the potential savings are likely to be, although of course the greater the complexity too. Several retailers could share, or retailers might share with their suppliers. A group of food

companies might even share with those from a different industrial sector. A group of businesses could collectively pool their assets. The use of white, unbranded (or multi-branded) vehicles delivering to and from consolidation centres, or making deliveries to several retailers in succession, could significantly reduce the number of journeys needed.

As we have also highlighted, with a regionally focused system the relative savings achievable through the shared use of infrastructure are also likely to be greater than those modelled in the Cardiff study report because all the environmental impacts will be occurring within the UK rather than overseas.

For all these possibilities, concerns will be raised about the risks to commercial confidentiality. Another perceived drawback for retailers is that by using anonymous white vehicles they are missing out on advertising opportunities.

These problems do not appear to be insuperable. Indeed retailers are already taking advantage of the financial savings sharing can offer. Panasonic delivers its products from Cardiff to Northampton and then, on its return journey to Cardiff takes Safeway products from the retailer's Tamworth RDC to its Bristol RDC. The consolidator, Fowler Welch, also delivers seven or eight loads a week to Safeway stores after it has dropped off loads at Safeway RDCs.³⁷⁶ Somerfield is adopting shared systems to solve the problem of empty lorries coming back from Scotland; Woolworths' stock is trucked to East Kilbride and then delivered to stores from the Somerfield depot. On the way back, drivers collect potatoes from a Somerfield supplier in Airdrie.³⁷⁷

In future years we may well see more collaboration between retailers, and between retailers and suppliers (as we are already seeing through factory gate pricing). These are promising developments since they show that collaboration is possible where the will exists. In order to shift more elements of the food industry in this direction, we need a clear policy lead from government. One option could be to provide incentives, such as a lifting of delivery hours

³⁷⁶ Ellen N, Strategy Manager – CSR, Safeway, personal communication, July 2003

³⁷⁷ *Supply Chain: an editorial supplement to The Grocer*, William Reed Publishing, West Sussex, 14 June 2003

restrictions for those who pool vehicles, distribution assets and delivery schedules. What we also need to see however – and what is often missing – is a very strong focus by policy makers and industry alike on collaboration for CO₂ reduction. Sometimes efforts to reduce costs lead to reductions in emissions but this will not always be so.

For urban areas, goods could be consolidated at urban distribution centres before making the final leg of the journey to store. While supermarket deliveries to store are already fairly efficient, this is much less the case for independent local stores, as we have seen. So far the success rates of city logistics trials have been patchy, to say the least.^{378,379} While some schemes have undoubtedly achieved enormous savings in vehicle-kilometres, participation in these trials has been limited. Other schemes have failed for various reasons, including poor management, loss or damage of goods because of the extra handling involved, and problems do to with commercial confidentiality. Despite these past failures, the principle of urban distribution is interesting. It is important to examine the options for developing workable schemes further since, if successful, they could help achieve the necessary co-operation and consolidation that the independent retail sector needs in order to improve its logistical efficiency.

There may also be scope, where centres are rail connected, for retailers to share rail deliveries; an option which might reduce costs all around.³⁸⁰ The smaller wagons now available for rail freight add flexibility to the rail freight option.

Finally, we suggest that we step back and consider what could be learnt by looking at different models, including non-mainstream retail and distribution structures. Supermarket distribution systems provide a vast range of food to a very wide customer base. And they do so more efficiently than many local stores, measured in terms of CO₂ per kilometre travelled. However, many of the easy battles, logistically speaking, have now been won. Barring a low carbon technological breakthrough, it may prove harder and harder to achieve further efficiencies in the coming years.

The first study we commissioned highlighted some overseas examples of co-operative food supply models which work differently from those of the supermarkets.³⁸¹ There are also many alternative UK based systems, such as vegetable box schemes, community-supported agriculture and farmers' markets, whose supply chains differ from those of the multiples. It is most likely that such systems would, if studied, reveal themselves to be less efficient, measured in tonne-kilometres, than supermarket movements of comparable products. This is not surprising. Many of these systems are small-scale, inadequately funded, volunteer-based and still evolving.

However, rather than ignoring, or dismissing these systems out of hand, these alternative supply chains should be looked at more closely. Some may contain elements which, once refined, developed and combined with mainstream technologies and logistical principles, could point towards lower carbon ways of doing things. Or they may not, as the case may be – the point is that at the moment we do not know. We suggest that further research be undertaken into the logistical arrangements of the alternative food sector, both with a view to improving efficiency within that sector, and to applying any good practice to mainstream systems.

7.6 Better use of Information and Communication Technology

Technology is critical to the development of a lower carbon food system. Intelligent transport technologies already help retailers optimise routing and scheduling patterns, in order to make the best use of vehicles and plan around road

378 Kohler U and Groke O, *New Ideas for the City-Logistics Project in Kassel*, in Taniguchi, E. and Thompson, R. (eds.) *City Logistics III: proceedings of the third international conference on city logistics*, 25-27 June 2003, Madeira; pp.331-344

379 Whiteing T, Browne M and Allen J, *City Logistics: the continuing search for sustainable solutions*, chapter in Waters, D, (ed) *Global Logistics and Distribution Planning: strategies for management*, Kogan Page: London, pp.308-320, 2003

380 Beecroft M, Lyons G and Chatterjee K, *Freight and Logistics: the seventh of eight reports from the Transport Visions Network*, Transportation Research Group, University of Southampton, Landor Publishing, London 2003

381 Mason R, Peckham C, Simons D and Wakeman T, *Wise Moves Modelling Report*, commissioned by the Wise Moves project, Transport 2000, June 2002

blockages and other occurrences. It is likely to grow in importance as factory gate pricing systems become more widely adopted with less standardised journeys.

But smart technologies could achieve more than this. They could help in deciding upon the best sourcing approaches for any given product based on information about energy use during the whole life-cycle of the product. For instance, they could help industry buyers choose between imported apples and indigenous ones (we bear in mind of course that CO₂ emissions reduction will not form the only basis for their decision – other environmental and social concerns, as well as produce quality and safety standards will also be included in their consideration). The development of such modelling and decision-making tools will require considerable investment in life-cycle research across different food sectors but the methodology is already becoming more established. The challenge is to develop ways in which this information could be applied in commercial decision-making situations. Ultimately such information could be bar-coded to enable information to be more immediately accessible, and could provide the basis for providing information to consumers about the CO₂ impacts of the food they buy.

Information and Communication Technologies could also supply up-to-the-minute information on the nature and availability of supplies – highlighting gaps, identifying when regional supplies are not available, pinpointing the nearest source beyond the region, and identifying potential for links between producers, manufacturers and retailers along the supply chain. Embryonic versions of this are already emerging; BigBarn, for instance, provides details of suppliers and retail outlets in any given area while the National Farmers' Union's SourceDirect links wholesale buyers with local producers of primary and processed goods. The websites of the regional food groups such as Northumbrian Larder and First4farming, an online agricultural marketplace, provide further examples. These separate initiatives need to be integrated and expanded to include not just speciality goods but also mainstream foods, together with information on regional processing plants, packhouses, abattoirs and so forth. All this information will need updating to take account of seasonal variation.

The widespread sharing of vehicles and distribution centres, as discussed above, would help create a more finely grained network of distributional opportunities. Such a function could build upon retailers' existing software as well as on existing e-based freight exchanges, where empty space on vehicles can be bought or sold, often through auction. Internet-based technologies can, moreover, pinpoint when the point beyond which the advantages of a short journey are outweighed by the disadvantages of a partial load for a given product.

At present, the technology, while still in the developmental stages, is on its way. But it is being put to many disparate uses. The goals of BigBarn, for instance, are to promote local sourcing and purchasing. E-based freight exchanges are about maximising vehicle loads in order to save money. Retailer software such as Paragon plans optimal routes. Life-cycle analysis software quantifies emissions at various life stages of the product. We need not just to build upon but also to *integrate* the principles and possibilities of existing innovations. And we need a clear force driving this integration; the goal of achieving a low carbon food chain.

The system we have in mind would thus be based on a comprehensive database of suppliers, manufacturers and retailers from plough to plate. A retailer looking for tomatoes would have access not only to a list of suppliers but also to the CO₂ implications of sourcing from those suppliers and the optimal routing strategies. This information would also take into account what other foods the retailer wanted to source – a slightly more distant source of tomatoes might be preferable if the nearest source of cheese, say, was also being picked up in the process. The system could be nationally co-ordinated, with regional information-gathering hubs, enabling detailed information to be gathered and then fed into the nationwide system. In response, industry would have to develop very fluid, responsive systems, which would need to vary according to the often changing characteristics of different products.

All this sounds extremely ambitious. It is. But we already have also sorts of highly sophisticated technologies enabling us to send space craft to Mars (possibly), communicate virtually across continents and – more prosaically – hold vast quantities of information about consumer

shopping preferences. Developing technology to help achieve lower carbon systems should be possible, given the will within industry and impetus and incentive from Government.

Developing such a system would need the involvement of many organisations, including the food industry, the English Food & Farming Partnership, environmental organisations, the IGD's Food Chain Centre, logistics experts, IT companies and of course Government, three key departments being the Department for Transport, DEFRA, and the Department for Trade and Industry.

From a policy-making perspective, an IT system of the sort described would also be invaluable when the EU emissions trading scheme comes into being, since industry would be able to gather more precise information about their emissions and take highly targeted action to reduce them. It may be, for instance, that a relatively few products are responsible for emitting disproportionate quantities of CO₂ (as highlighted in section six) and that fairly painless modifications in their sourcing strategies could achieve considerable reductions. This would help them meet the 20% carbon reduction target proposed earlier.

Once established, maintaining the technology, vehicles and distribution assets would be a considerable task. Hitherto, such control has been shared by the retailers, the wholesalers or the third-party logistics providers (3PLs) such as Exel or Tippet & Britten. For a lower carbon food chain, we suggest 3PSs instead – third-party sustainability providers.

This new generation of Exels would not only manage the technology and other assets but they would also provide emissions information to the retailers, who could make their buying decisions in the light of that information. 3PSs could also be contracted to take on responsibility for quality control and traceability – in other words for

ensuring that the products available on the database meet certain standards. Within a regional food structure this could well be an easier task than it is today. Product uniformity and other cosmetic standards, as we discuss below, may not feature so highly, but safety and other specifications certainly will. The use of a 3PS would also help alleviate some of the concerns about commercial confidentiality, although not all retailers will wish to outsource control. The functions we have sketched out could also be carried out by the retailers themselves.

The issue of home deliveries also needs considering. At the moment retailers are vying in their attempts to offer the most flexible and reliable service. However, this drive towards ever more convenience for the consumer is not necessarily the soundest approach from a transport perspective. A more energy-efficient option might be to vary the price structure so that people living in the same neighbourhoods ask for deliveries at similar times. Alternatively, retailers could charge lower delivery rates to customers who are prepared to wait several days for their deliveries, as this provides retailers with the opportunity to plan their routes more effectively.

The supermarkets are showing signs of heading in this direction anyway, as they begin to get to grips with their home delivery systems. There could, however, be an explicit focus on engaging customers themselves with the issues by pointing out to them that advance ordering means lower emissions. Framed in this way (and with the additional cost incentive) customers may be more prepared to wait.

7.7 Different retail structures

The nature of shops themselves – what kind of store they are and where they are located – also influences the sustainability of the supply chain. The analysis in section six suggests that we may need different shop types to suit the distributional needs of different products, a possibility which, interestingly, was raised in an independent report by the University of Southampton's Transportation Research Group³⁸² as well as the research which the *Wise Moves* project commissioned.³⁸³

The Southampton report suggested that we might need two main kinds of store. The first

382 Beecroft M, Lyons G and Chatterjee K, *Freight and Logistics: the seventh of eight reports from the Transport Visions Network*, Transportation Research Group, University of Southampton, Landor Publishing, London, 2003

383 Ecologica, *Wise Moves Modelling Report: sourcing and distribution options for bread, cheese and chicken*, commissioned by the *Wise Moves* project, Transport 2000, June 2003

would be for durables – for those goods which we do not buy especially often and which either cannot be sourced locally or which may benefit, in energy terms, from being produced more centrally (more on this below). Rice, jam, pasta and biscuits are possible examples. People would buy these foods fairly infrequently (once a month, say) and buy large quantities. While the marginal cost, in environmental terms, of driving to buy them is not as great as for other foods (see below), public-transport-out, taxi-back type systems would reduce the environmental impact. Home deliveries may also reduce car travel, although as we have highlighted, this last point is contestable. There are likely to be relatively few of these stores.

The second type of shop would be for perishables – those foods which we need to buy two, three or more times a week. The Southampton report calls these ‘freshgrocers.’ These shops would sell bread, fresh vegetables, and so forth. Given the need to buy these foods frequently, the marginal environmental cost of driving to do so can be very significant indeed, as our research has shown. There is a real advantage here in shopping at local outlets which people can reach on foot, and as such there should be many of them, accessible to most people wherever they live. We might add that if Government’s attempts to get us to eat more fruit and vegetables are successful (see below), these types of food, and the retail outlets providing them, will grow in importance, and the total volume of sales of these foods will increase. This will have both sourcing and distributional implications.

There are also foods which we might class as borderline; these include the chicken and cheese which we studied. As these products have a high embodied energy (see glossary), where they are sourced from and how they are processed are much more important factors than how the shopper travels to get them. From a practical point of view, however, these foods are bought reasonably frequently and as such they would need to be stocked in local shops. There would, of course, be some overlap – someone running out of rice, say, should not need to travel all the way to a durables store – but the principle of two types would stand.

Such a system bears more than a passing resemblance to the old idea of a diverse high

street, populated by greengrocers, butchers, bakers and so forth. It might also be argued that the Tesco Metro-style supermarket formats perform the function of a ‘freshgrocer.’ The essential difference between the model suggested and existing ones is that the functions of the shops, and the type of goods on offer there, are expressly in keeping with objectives to minimise transport-related emissions. This cannot be said of the present situation which, as we saw in section four, has developed the way it has for an entirely different set of reasons.

Does this different retail structure have a bearing on the supermarkets versus independent shops question? It would, in fact, be possible for both models of ownership to co-exist for both store types. We could have independent stores for durables and freshgrocers owned by multiples, or vice versa, or a combination of the two.

However, it is important to note that a varied pattern of retail ownership is intrinsic to our lower carbon objectives. The Competition Commission has found that retailer concentration reduces the negotiating power of British farmers and manufacturers.³⁸⁴ As such this concentration undermines the development of a strengthened farming and manufacturing sector whose presence, we have suggested, is essential if we are to achieve a lower carbon food system. If, in the absence of other retail outlets, farmers and manufacturers have little choice but to sell to the multiples³⁸⁵ then they also have to accept the terms which the multiples offer. If they refuse these terms, the multiples can look overseas or further afield within the UK for cheaper supplies. And if this happens (and it is already happening), British farming and British manufacturing will die and there will be no indigenous supply base from which to source. The only alternative then will be to source from overseas. The consequences will be more greenhouse gas emissions.

In effect, then, a strengthened, invigorated and diverse UK farming and manufacturing supply base is inextricably linked with a strengthened, invigorated and diverse retail sector, and both are fundamental to a less carbon-intensive supply

384 *Supermarkets: a report on the supply of groceries from multiple stores in the United Kingdom*, Competition Commission, London, 2000

385 This usually happens via an intermediary such as a product marketing organisation

chain. Action to foster such diversity is important since these very independents which we would wish to see more of operate very inefficient distribution systems.

What policies are needed in order to achieve this objective? For one, we need to see a vastly strengthened supermarket Code of Practice applied to all the main retailers. The present one is ineffectual and the Office of Fair Trading is currently in the process of reviewing it. Government also needs to appoint an independent watchdog to ensure that food industry players are complying with the code.

We also need to see much more support for small retailers so that suppliers are able to go elsewhere if they are not happy with the terms on offer from the supermarkets. Such support could take the form of tax relief for independently owned stores or a statutory limit on the market share of any one company.

Clearly we do not want to see a strengthened independent retail sector which nevertheless continues with highly inefficient distributional systems. Policies to promote independent retailers must go hand in hand with policies to improve the distributional efficiency of all retailers, whatever their size and ownership model.

Finally, although we may need a different balance of ownership within the food retail industry, this does not necessarily mean that in absolute terms we need any more shops. Most of us (and there are still exceptions) – have more or less enough to eat. Most of us, and with the important exception of some rural areas, have access to a vast range of products sold in shops that are usually very close at hand. Government therefore needs to tighten planning legislation considerably in order to prevent supermarket expansion and the environmental impacts that ensue; it is to be hoped that the forthcoming PPG6 will address this issue.

7.8 Different eating habits

A lower carbon food system would mean fairly substantial changes to the way we shop and eat. This jars with the food industry's often predestinarian view of consumption trends. The

role of the food industry is to predict and provide for its powerful and increasingly demanding customers. Curbs on the consumers' right to choose are seen to be not just uncommercial, but undesirable and, in a free market economy, extremely difficult to achieve.

Partly in response to this approach, environmentalists at times fall over themselves to deny charges of austerity and to promote their win-win-win vision as being at once green, healthy, hedonistic, convenient, cutting edge, great for the kids and just about everything else as well. The truth is however, that if we are to see major reductions in greenhouse gas emissions from our food system, then something will have to give and that something is likely to be the dazzling array of choice that we currently, and undoubtedly, enjoy.

The approach does not need to be absolutist. We do not suggest a ban on eating cherries. But while a little bit of what we fancy does us good, we might question whether more is better still. Does one ultimately gain more by eating cherries from February through to October rather than for a short month or two? A life-cycle analysis of pleasure is not proposed, but we do suggest that measures to discourage 'season creep' might be helpful, and only a minor infringement of the inalienable right of everyone to eat anything anytime anywhere.

Such changes will not be easy to implement. In order to move in this direction, we propose the following possible approaches, and discuss them in more detail:

- (a) *Pricing* foods in ways which reflect the environmental damage they cause.
- (b) *Persuading* people to eat differently by informing them of the issues and making it more attractive for them to do so.
- (c) *Providing* lower carbon food – people can only choose to eat more sustainably if such food is available.
- (d) *Planning* for lower carbon eating in ways that harmonise with other government objectives, such as that of fostering healthier eating.

Some of these are actions which government and local government alone can take. Others will require business commitment.

Pricing food

Some foods are produced, sourced and distributed in such carbon-intensive ways³⁸⁶ that we need to send clear economic signals to dampen public enthusiasm for them. Many measures to curb long distance transport will only increase the price of those products very slightly. We have argued that we also need fiscal measures in place to reduce energy use in other life-cycle areas, including through an increase in the Climate Change Levy. The consequence of these fiscal measures may be higher end prices to the consumer.

Government will need to tackle this problem in a number of ways. To start with, this rise in energy costs to business could be mitigated by deploying other measures to reduce costs in other, non polluting areas. The lower rate of employee National Insurance Contributions, imperfect as it is, is one approach.

Government also needs to take steps to make higher priced food more politically acceptable. Many organisations³⁸⁷ argue that the price of food fails to reflect the social and environmental costs of production. Climate change features prominently in their list of concerns. Of course action to raise the cost of food is hardly going to win votes. Nevertheless it is argued that since we already pay for these costs indirectly through taxes (for instance to fund NHS treatment of diet-related illnesses), pricing foods more transparently will enable consumers to demand foods produced in ways which are less damaging. Lower carbon food may ultimately be the cheaper option.

In the short term at least though, the cost of food will rise. Some have argued that increasing the cost of food is a regressive move that will harm the poor most. It is important, however, to distinguish between two types of transport-intensive food. The first is the luxury product, such as Thai baby corn. These foods are mainly eaten by wealthier people and increasing the price of these will not be regressive.

A more serious concern is that the cost of everyday cheap foods, such as processed meals made of imported chicken, may increase. This is potentially a problem but there are ways of approaching it. The first is that many food policies and pricing structures are already regressive. 'Junk' food fills people up more

cheaply than fresh fruit and vegetables.³⁸⁸ More poor people than rich die from diet-related illnesses.³⁸⁹ Some have already advocated measures to raise the cost of unhealthy foods³⁹⁰ on the grounds that these would be comparable in their intent to a tax on tobacco.

We do not propose a carbon tax on top of the energy-related fiscal disincentives we outlined earlier, since the latter would in any case raise the cost of food. Our point here is simply that policy makers are already considering the scope for altering the the structure of food pricing in order to fulfil social objectives, and that arguments for pricing food to reflect its climate change impacts sit within the context of this debate.

The second point to make about higher food prices is that branding is key. Research suggests that people from almost all socio-economic groups are prepared to pay for branded food even if in blind tests those foods are sometimes not liked as well as their unbranded rivals.³⁹¹ Hence for most consumers there might be said to be some 'slack' in the budget. The challenge would be to brand lower carbon food in appealing ways that convince people that it is worth paying that marginal extra.

The third and perhaps most important point is that policy-making should never occur in isolation. We need to ensure that government policies harmonise with one another. Measures which end up raising the cost of some foods need to be balanced with policies that lower costs in other areas for low-income consumers. This can include making lower carbon, healthier foods more readily and cheaply available to low-income consumers. This is certainly not the case at the moment. The Maternity Alliance, for instance,

386 Jones A, *Eating Oil: food supply in a changing climate*. Sustain and Elm Farm Research Centre, London, 2001

387 *Final Sustain Response to the Consultation Document issued by the Policy Commission on Future of Farming and Food*, Sustain, London, January 2002, www.sustainweb.org/pdf/curry.pdf

388 *Food Poverty: policy options for the New Millennium*, Sustain, London, 2001

389 *Independent Inquiry into Inequalities in Health*, report of the independent Inquiry into Inequalities in Health (Acheson Report), London, the Stationery Office, 1998

390 Marshall T, *British Medical Journal*, 320, 2000

391 Lury G, *Adwatching*, Blackhall Publishing, Dublin, 2001

argues that means-tested welfare benefits are still too low to support optimum maternal and child health.³⁹²

Persuasion

It is important to make lower carbon food attractive to shoppers. We suggested above that Government might issue a challenge to the food industry to cut carbon emissions by 20%. Such a move could bring with it all sorts of promotional and marketing opportunities. Consumers would be made aware of the link between climate change and their eating patterns but would be very gently introduced to the subject without need for gustatory sacrifice.

We also need to offer consumers a range of options. As an example, take lettuce. Measures which shift us towards a lower carbon food system need not deprive us of shredded iceberg lettuce garnishes. What carbon-reducing policies can do instead is provide us with a range of various options (together with more information about the consequences of the choices we make). If we want something green to go in our sandwiches, we could buy imported icebergs from the nearest possible overseas source. Or we could eat UK-grown lettuces, produced in a more sustainable manner following investment in cleaner greenhouse technologies or in the breeding of more cold-tolerant varieties. Or we could be offered something more seasonal to put between our bread instead – shredded cabbage for example, or rocket, or lambs' lettuce. An acceptable approach might be to develop a balance between all three options, and the balance will be different for different foods.

It will also be important to market and promote regional and national foods more effectively. In some instances and for some foods this will be easy – some regional foods are flying off the shelves. However a more regionally focused system is about more than clotted cream. It is also about everyday foods which, in a regional system are likely to be more variable in, for instance, size and colouring. Such variability will

present challenges to marketing departments. We do not suggest that bad products be fobbed off on consumers. This would in any case not work; even good advertising cannot sell bad food. What we highlight is the need to think creatively about how such variability is presented. To take an example from textiles, consumers now accept that the 'imperfections' of raw silk are part of its beauty.

Once we know more about the CO₂ impacts of products (aided by the technology described above), retailers will be able to provide that information to consumers, through labelling and point-of-sale information. This will enable consumers to make informed decisions about the food they are choosing. Although roughly half of all consumers do not read labels, this nevertheless leaves an equal half which does.³⁹³ The Advisory Council for Consumer Products and the Environment could encourage Government to take a lead here. Those supermarkets running loyalty card schemes could also promote lower carbon foods by directly linking purchases to bonus points.

Providing these foods is not in itself enough if people then go on to cook them in ways which waste energy. In section four we highlighted the growing popularity of convenience and processed foods. In section six we looked at the CO₂-related arguments surrounding home-cooked versus commercially-prepared meals, highlighting the absence of research in this area. We also suggested that a narrow life-cycle approach might be too limited to allow for the complexities of people's behaviour and emphasised the need to take account of any second-order consequences that could result from changes in the way we cook and eat. Whatever the balance, for the time being most people will continue to cook at least some of the time. Action to improve the efficiency of domestic cooking appliances and to encourage people to buy electricity from renewable providers will continue to be very important and should form part of a lower carbon food strategy.

Providing lower carbon food

Public procurement accounts for a sizeable proportion of total food eaten. The annual food bill of the National Health Service (NHS), the largest employer in the country, is around £500

392 *Healthy Start Consultation Meeting*, Maternity Alliance, London, November 2002, www.maternityalliance.org.uk/welfare.doc

393 *Consumer Attitudes Survey*, Food Standards Agency, London, 2001

million.³⁹⁴ Tackling the NHS food sourcing and distribution system represents an enormous opportunity for achieving carbon reductions. There are also local authorities, schools and other public sector establishments to consider. School meals now have to meet minimum nutritional requirements; an essential further step must be for caterers also to have to meet minimum environmental standards, in accordance with sustainable procurement guidelines. Where there is a potential clash between nutritional and environmental objectives (and in most cases there need not be), then nutritional requirements should take precedence.

As we discussed earlier, the regulations governing public procurement are at best confusing and at worst highly limiting. However, in August 2003, Government launched a major review of the way the public sector obtains its food and catering services.³⁹⁵ The review will, among other things, look at energy issues. This is to be welcomed and supported.

Planning for lower carbon eating

It is especially important that policies to promote less carbon-intensive sourcing and distribution work with, not against, health objectives.

The critical issues, as far as nutritional health is concerned, are the rise in obesity, particularly among children, and the link between our poor diet and nutrition-related illnesses such as coronary heart disease, stroke, some cancers and diabetes. It is now generally accepted that a diet rich in fruit and vegetables can help prevent the onset of such diseases, and health bodies worldwide, including the UK's Department of Health (DoH), urge people to eat more of these foods. Supermarkets and many food manufacturers are also promoting the five-a-day message both in the fresh produce aisles and through their processed ranges.

It is not joined-up thinking to promote Vitamin C rich air-freighted blueberries if in the process we undermine Government's own climate change objectives. Government food policy has until now had nothing to say about the health-environmental relationship even though the DoH's own research³⁹⁶ indicates that the direct health impacts of climate change in the UK alone are likely to be very considerable. The DoH needs to

ensure that the policies it puts in place to promote better nutritional health are compatible with the goals of environmental sustainability, and it should require health development agencies and other health promotion bodies to do likewise.

Government also needs to consider what, logistically, would happen were people to change their eating habits in accordance with Government recommendations. Five portions of fruit and vegetables a day and fewer calorie-dense (and therefore compact) foods might mean different logistical patterns – possibly more frequent journeys from supplier to store but fewer intermediary journeys for production and processing. It may also need different patterns of shopping. Some of these fresh foods will need refrigerating and it is difficult to fit a week's worth of fruit and vegetables for a family of four into an ordinary fridge. A shift towards larger fridges to hold all this food would fall foul of objectives to reduce emissions from refrigeration. Assuming that the DoH is confident that the policies it has put in place will work, it clearly needs to work with the DFT to look at ways of delivering, in the most literal of senses, its five-a-day message to the average British home. As far as the customer leg of the supply chain is concerned, the two types of shop highlighted above would provide a solution, since instead of buying a week's worth of fruit and vegetables, we would buy them three or more times a week, on the way home from work. Many people as it is shop on the way home for top-up foods and ready-meals. If trends continue, with more people living alone, it is quite possible that this pattern of shopping will fit well with their increasingly autonomous life styles.

To encourage this pattern, we need to develop more disincentives to car-based shopping together with positive improvements to the street environment to encourage cycling and walking. The new PPG should make clear the need for strong limits on car parking availability at supermarkets and other large stores.

394 *Claiming the health dividend: unlocking the benefits of NHS spending*, King's Fund, London, 2002

395 'Sustainable' food and catering services for the public sector – initiative launched, news release, DEFRA, London, 26 August 2003

396 *The Health Effects of Climate Change*, Department of Health, London, 2001

7.9 We still don't know enough

Evidently there is a need for far more research to understand better some of the issues which this report covers. In particular we need to:

- Refine life-cycle analysis methodology and expand the database on which LCA calculations are made. Importantly, we also need to develop ways of applying life-cycle data to commercial contexts so that food buyers can easily access and use such information when making decisions.
- Develop ways of undertaking life-cycle analyses for whole sectors of the food industry, as opposed to specific products. This will help in the early stages of assessing food's carbon impacts, as individual life-cycle analyses for all products will present a considerable challenge.
- Examine the contribution that UK consumption patterns make to overseas food transport, and to the CO₂ emissions that arise.
- Map the regions. For each region we need to work out what people eat, where it comes from and where and how it is produced. We need to consider not just food but other inputs to the food chain, such as packaging. We also need to take a year-round perspective.
- Examine the logistical effectiveness of alternative distribution systems highlighted in the first commissioned study,³⁹⁷ as well as UK box or community-supported agriculture schemes. We need to consider whether these models have potential to yield carbon savings and if so whether there is scope for refining, building upon and applying such systems to a more mainstream context.
- Consider the impact of Protected Status (Appellation Contrôlée) foods on food transport emissions.
- Identify where new infrastructure, such as pack-houses, consolidation centres,

processing plants, abattoirs and so forth may be needed in order to help the development of *shorter-plus* supply chains.

- Research the scope for developing successful urban consolidation and distribution models and consider in particular the role they could play in improving the logistical efficiency of the independent retail sector.
- Examine the logistical arrangements of the alternative food sector, both here and where there are established models overseas.
- Look more closely at the impact of the food service sector on freight emissions as well as on other life-cycle areas such as food processing and preparation, refrigeration and storage.
- Assess further the strengths and weaknesses of regional and national sourcing patterns, in keeping with the DfT's recent work on supply chain vulnerabilities. Consider in particular how to ensure that *shorter-plus* supply chains of the kind described are as resilient as possible.
- Develop appropriate methods of conducting energy life-cycle comparisons between processed ready-meals and home-cooked meals.
- Examine ways of increasing people's understanding of the environmental implications of their food choices.
- Examine further the potential for developing a two-store-type model (embracing all retail ownership models), considering both the effect on emissions from distribution and from shopper transport.

7.10 Conclusion

This section has suggested some ways in which we could move towards a lower carbon food system. The measures we have outlined will require changes in some Government policies and a strengthening of others. They will require changes both in the structure and in the behaviour of the food industry. And they will require changes in the way we, as consumers, shop and eat.

³⁹⁷ Mason R, Simons D, Peckham C and Wakeman T, *Wise Moves Modelling Report*, commissioned by the *Wise Moves* project, Transport 2000, June 2002

With the right policy framework and the right degree of political will, we believe many of the measures we propose can be readily implemented. Others, however, will be harder to put in place. A low carbon food system will ultimately look very different from the one we have at present, and will require us all to rethink many of our core assumptions about shopping and consuming.

Eventually however, change we must. The existing system cannot deliver the greenhouse gas reductions that we desperately need to achieve at the rate we need to achieve them. And despite the quality, the diversity, the abundance and the affordability of the vast range of foods on offer it may be that the system as it stands does not, ultimately, fulfil our needs.

We are paying less and less for environmentally damaging food that we have less and less time to eat, because we are too busy achieving an economic prosperity that we do not appear very much to enjoy³⁹⁸ and which in itself is contributing to the problem of climate change.

We suggest it might be time to sit back and assess whether the looking-glass situation we have built for ourselves is really worth having.

As Jonathan Porritt, Chair of the Government's own advisory body, the Sustainable Development Commission puts it:³⁹⁹ *'It took the best part of 20 years to demonstrate that economic growth and increased energy consumption were not inextricably wedded, and that it was perfectly possible to secure high levels of economic growth without corresponding increases in energy consumption. But will it really take another 20 years to persuade politicians that one can decouple improved societal wellbeing and individual happiness from high levels of consumption? If it does, sustainable development is pretty much a dead duck.'*

398 *Redefining Prosperity: resource productivity, economic growth and sustainable development*, Sustainable Development Commission, London, 2003

399 Porritt J, *Odd Couple*, Society section of *The Guardian*, 9 July 2003

Section eight

Recommendations

These recommendations summarise the policy proposals we outlined in section seven, grouped in accordance with the nine key areas identified.

1 Recognise that the status quo is not sustainable (see section 7.1)

Government should:

- Set a target for the food industry to reduce field-to-store CO₂ emissions by 20% over ten years.
- Make lower carbon food a clear cross-departmental policy objective.
- Incorporate food emissions reduction into the aims and work plans of all Government departments and agencies, and in particular DEFRA, the DfT, Department for Education and Skills (DfES), Department of Health (DoH), Department for Trade and Industry (DTI) and the Food Standards Agency.
- In the follow-on work from the Energy White Paper, implement a cross-departmental and organisational work programme to research, promote and help achieve lower carbon food chains.

The main food industry players should:

- Measure their CO₂ emissions from all sources (including those generated overseas) and develop policies and targets for reducing them in line with the government target above. They should report on their progress in corporate social responsibility and annual reports.

2 Aim for a low carbon food chain (see section 7.2)

Government should:

- Focus attention and funding on the research, development and application of greener technologies across the food chain, including in agriculture, horticulture, food processing, refrigeration (both in situ and in transit), storage and waste disposal.
- Encourage greater transparency and consistency of company greenhouse gas reporting to enable comparisons between companies and over time to be made.
- Ensure carbon reduction is a clear criterion of sustainable procurement contracts.
- Provide more support to enable smaller businesses to reduce their carbon emissions.

3 Develop measures to promote regional sourcing patterns (see section 7.3)

Government should:

- Promote and develop, through grants and regulation, the infrastructure and other aids to the development of more regional sourcing patterns. This will, among other things, include support for the development of:
 - More and smaller abattoirs, cutting rooms and so forth.
 - More (and more diverse) horticultural and agricultural enterprises.
 - More consolidation centres and other logistics-related infrastructure.
- Expand Food from Britain's remit to focus on supporting mainstream and not just 'value-added' foods.

- Set reduced maximum journey limits for the transport of live animals.
- Campaign for changes to EU public procurement requirements to enable procurers to purchase goods on the basis of environmental and social as well as economic considerations.

Regional Development Agencies should:

- Carry out detailed food maps. These maps should identify what is eaten, where the food comes from and what the environmental implications are. They should also identify where nearer sources of such foods exist and where there could be scope for developing enterprises to fill gaps in regional availability. Non-food elements, such as packaging, also need to be included.
- Provide support for infrastructure (including that detailed above), for the development of enterprises to fill gaps in availability, and for the marketing of regional foods.

The Food Chain Centre should:

- Broaden its remit to include environmental sustainability, part of which will entail fostering lower carbon food chains.

4 Put in place measures to curb energy-intensive transport (see section 7.4)

Government should:

Recognise that we need absolute, and progressively declining limits on food freight transport emissions both in the UK and from UK-owned traffic overseas. To help achieve this reduction:

- Monitor the impact of the lorry charge on CO₂ emissions and consider ways of altering the charging structure, so as to help achieve an absolute decline in emissions from freight transport.
- Review the criteria and scale of the road-building programme.
- Review those proposals for airport expansion which are based on a projected increase in freight movements.

- Reduce non-UK food transport emissions through the development of economic instruments, including a European or internationally applied aviation emissions charge. Work within the EU and International Civil Aviation Organisation respectively for their implementation at the earliest opportunity.

- The DTI and Department for International Development (DfID) should examine the scope for UK businesses to invest overseas in products which produce lower carbon emissions both at the production and at the transport stages and which provide viable alternatives to air-freighted horticulture.
- Continue and strengthen measures to promote rail and short sea shipping.

5 Develop better distribution and collaborative working (see section 7.5)

National and regional government should:

- Develop frameworks to promote collaboration for CO₂ reduction among retailers of all sizes. This might include incentives such as removing restrictions on deliveries made by lower emission vehicles at certain times of the day.
- Examine ways of promoting collaboration and the use of shared infrastructure among different elements of the food industry.
- Focus attention on improving the distributional efficiency of smaller players and consider measures to encourage improvements.
- Consider the potential role of urban distribution centres and develop trials to test their use and effectiveness.
- Examine the distribution systems of public bodies (such as the NHS) and examine ways of improving their efficiency.

The food industry should:

- Build upon the improvements they are already making and examine ways of collaborating along their supply chains.

Other agencies should:

- The English Food & Farming Partnership should, as part of its work to promote co-operation and collaboration among farmers and food manufacturers, consider the scope for improving the distributional efficiency of these enterprises.

6 Utilise Information and Communication Technology for carbon reduction (see section 7.6)

Government and the food industry should:

- Examine the potential for developing integrated Information and Communication Technologies to help the food industry make lower carbon sourcing and distribution decisions. Such a system would provide information about CO₂ emissions throughout a product's life-cycle, enabling decisions to be made about source (based on embodied energy, distance, mode and conditions of delivery), route and vehicle type.

Government should:

- Provide financial support for the development and application of such technology in a commercial environment.
- Work to ensure that such technology is available to, affordable for and adopted by retailers of all sizes.

7 Establish different retail structures (see section 7.7)

Government should:

- Introduce a strengthened Code of Practice for supermarkets and appoint an independent watchdog to ensure compliance with the code.
- Continue to tighten planning legislation to curb out-of-town food shopping.
- Develop other policies to discourage car use and encourage non-car based food shopping.

8 Encourage different ways of shopping and eating (see section 7.8)

Government should:

Require the DoH to ensure that the policies it puts in place to promote better nutritional health are compatible with the goals of environmental sustainability, and require health development agencies and other health promotion bodies to do likewise. As part of this the DoH should:

- Work with the Department for Transport to consider the logistical implications of the five-a-day fruit and vegetables message.
- Place a clear focus on carbon emission reduction in its work on sustainable procurement.
- Explore ways of raising awareness among consumers of the hidden social and environmental costs in our existing food system, and persuading people of the need for food pricing which better reflects those hidden costs.

9 Further research goals (see section 7.9)

Government should:

Prioritise lower carbon food research. It should provide sufficient funds and support for such research. In the first instance we need to undertake more work to:

- Refine life-cycle analysis methodology and expand the database on which LCA calculations are made. Importantly, we also need to develop ways of applying life-cycle data to commercial contexts so that food buyers can easily access and use such information when making decisions.
- Develop ways of undertaking life-cycle analyses for whole sectors of the food industry, as opposed to specific products. This will help in the early stages of assessing food's carbon impacts, as individual life-cycle analyses for all products will present a considerable challenge.

- Undertake research into the relative energy efficiency of small and large-scale manufacturing enterprises for commonly eaten goods such as cheese, bakery products, fruit juice and so forth.
- Examine and quantify the contribution that UK consumption patterns make to food production and transport emissions generated overseas.
- Develop appropriate methods of conducting energy life-cycle comparisons between processed ready-meals and home-cooked meals.
- Examine the logistical effectiveness of alternative distribution systems highlighted in the Cardiff study,⁴⁰⁰ as well as UK box or community-supported agriculture schemes. We need to consider whether these models have carbon reducing potential and if so whether there is scope for refining, building upon and applying such systems to a more mainstream context.
- Identify where new infrastructure, such as pack-houses, consolidation centres, processing plants, abattoirs and so forth may be needed in order to help the development of *shorter-plus* supply chains.
- Examine the merits of developing different, lower carbon retail structures based on maximising opportunities for non-car based shopping.
- Consider the impact of Protected Status (Appellation Contrôlée) foods on food transport emissions.
- Look more closely at the impact of the food service sector on freight emissions as well as on other life-cycle areas such as food processing and preparation, refrigeration and storage.
- Assess further the strengths and weaknesses of regional and national sourcing patterns, in keeping with the DfT's recent work on supply chain vulnerabilities. Consider in particular how to ensure that *shorter-plus* supply chains of the kind described are as resilient as possible.
- Examine ways of increasing people's understanding of the environmental implications of their food choices.
- Undertake more research into ways of sustainably extending the growing season of UK produce.
- Carry out further work into the potential impact of the growth in light goods vehicles and the contribution that food movements make to this growth. Examine the scope for improving both their technological and logistical efficiency.

400 Mason R, Simons D, Peckham C and Wakeman T, *Wise Moves Modelling Report*, commissioned by the Wise Moves project, Transport 2000, June 2002

Annex one

Localism: The debate

The following paragraphs set down, in simple form, some of the arguments for and against localism. Clearly the issues are complex and in reality opinion does not divide neatly into two camps. Not all advocates of local food are concerned about food miles, and there are many critics of globalisation in its current form who would not call themselves localists. There are also many enthusiasts for globalisation who nevertheless believe that local food is a good thing.

The arguments 'for'

Critics of the existing globalised food production system include non-governmental organisations representing a wide range of interests and concerns. In summary, they argue that the globalised food supply chain:

Produces excessive greenhouse gas emissions:

Heavy reliance on mechanised farming, fossil-fuel intensive pesticides and fertilisers, the long distance transport of foods and sophisticated processing use vast quantities of fuel which, in turn, generate greenhouse gas emissions. The longer food travels, critics argue, the more energy-intensive refrigeration it may need, and the more packaging. Plastic packaging will be oil-based and all forms will have used fossil fuels during the manufacturing process. The trucks used to take the resulting waste to landfill will also emit CO₂, while some packaging will also generate climate changing methane emissions as it decomposes. Intensive agricultural production of a few crops within a given region has replaced mixed cropping systems, and in so doing has reduced regional self-sufficiency and created a need to transport food over longer distances.

Fails the environment in other ways:

Industrialised farming systems in the UK and overseas rely heavily on artificial inputs which damage the soil and water. Intensive monocultural systems reduce genetic diversity, lead to the loss of many indigenous seed varieties, and create an arid landscape which cannot support birds and other species. Forests and other natural habitats have been cleared and replaced with intensive agricultural systems.

Fails British farmers: The food and farming industry is controlled by large-scale intensive farmers, multinational manufacturers, and a handful of retailers with, it is argued, very poor returns offered to smaller farmers both in the UK and overseas. UK farmers are unable to compete with cheaper overseas produce, the result being that family farms are in decline, farmers are leaving their profession in droves, rural-based employment opportunities are scarce, rural shops and services are closing down, and parts of the countryside are turning into sterile leisure theme-parks comprising second-homes and commuter villages.

Fails the developing world: Developing world farming is controlled by multinational food and pharmaceuticals companies. Many of those producing successfully for export are the larger, highly industrialised farmers. A focus on cash cropping for export at the expense of production for indigenous markets undermines local food security and reduces the nutritional quality of people's diets.

Fails consumers: The apparent 'choice' offered by supermarkets is illusory – instead of genuine variety and diversity based on locally distinct foods and traditions, consumers are offered standardised exotica, with cosmetic perfection

taking priority over taste or nutritional quality. Our demand-led retailing system has helped create an abundance of heavily processed, fatty and sugary foods which damage our health. Although food is cheaper now than ever before, it costs consumers in other ways, through the taxes they pay to rectify the damage caused by rising levels of obesity and heart disease, and increasingly through the food system's generation of climate changing emissions and other forms of environmental damage.

Is not actually free trade: Because there is one set of trade rules for the rich and another for the poor. The distorted trade agenda means that traditional subsistence farming in developing countries is replaced by a vicious cycle of cash-cropping for export, the loss of indigenous self-reliance, declining household incomes and consequent increased reliance on cash-cropping for export. At the same time the EU and US subsidise their own farmers, who often dump surplus products on international markets, distorting the market and driving down local market prices for farmers.

Is unnecessary: We simultaneously import and export identical products, such as milk products or beef, with profits for some but environmental and other costs for society.

The arguments 'against'

Major retailers and manufacturers have responded to their critics by arguing that:

The CO₂ sums are wrong: Distance is an inadequate gauge of greenhouse gas production. The devil lies in the detail and the whole life-cycle of a product has to be considered before a judgement can be made regarding the merits of sourcing it more locally. For instance:

- The energy used to heat glasshouses for local crop production might outweigh the energy used to transport products from sunnier countries where no glass-housing has been required.
- Distance can be misleading – an apple sourced from New Zealand, say, will have been brought in by ship (a relatively low emitter of CO₂) whereas a French one will have arrived on a far more polluting truck.

- Air freighting can reduce impacts in other areas: it is possible that transporting produce by a slower, more sustainable mode (e.g. ship) might be more damaging than air freighting it; on a ship more time is spent in transit, which means more time in greenhouse gas intensive temperature-controlled storage. It may also mean that the product has a shorter shelf-life and there is therefore a risk that some food will be wasted, representing 'unnecessary' greenhouse gas emissions.
- Local can be misleading: a side of British beef, with the cow having been fed on numerous shipments of imported feed, may embody more transport-related CO₂ emissions than its imported Brazilian equivalent, which has eaten feed grown near to where it is reared.
- Small is inefficient: local food processing plants may be less efficient to run, in terms of cooking energy, heating, refrigeration and lighting than a larger, more distant plant, even though production at the former will mean less transport for the goods. The same may apply to local warehouses and consolidation centres.
- A year-round perspective is necessary: a Cox which has been stored at 2°C for over four months will have generated considerable quantities of emissions, perhaps more than a new-season New Zealand Granny Smith, shipped-in (a relatively low carbon mode) and stored for a matter of weeks, not months in transit. Long storage also leads to some food waste which itself represents wasted fossil-fuel energy and which, in its disposal, can generate methane.

There are other environmental factors to consider: For instance growing conditions in the UK might need more intensive use of fertilisers and pesticides, whereas an equivalent product grown in more favourable agricultural circumstances overseas will require fewer inputs. It is not always possible to make meaningful or objective comparisons between the importance of different impacts and ultimately any decisions will have to be based on somebody's judgement. Furthermore supermarkets are also working hard to improve the environmental standing of the food they sell through, for instance, the encouragement of Integrated Crop Management

by their suppliers and the elimination of genetically modified ingredients from their own-label food.

Trade is essential to the developing world:

Whether we like it or not, international trade is here to stay and farmers in the developing world have been only too eager to engage with the cash crop economy. By trading with developing world farmers, the food industry provides opportunities for them to earn much-needed income.

'Traditional' indigenous systems (such as share cropping) based on pre-capitalist feudalist or caste hierarchies were often brutal and exploitative and, by contrast, many multinationals and retailers abide by strict ethical codes of conduct. Indeed, many provide education, housing and healthcare to farmers and their families.

Free trade isn't actually free: The analysis of the problems of free trade are similar to those articulated above. However the solution, it is argued, is not to dismantle the free market but to liberalise it properly. A truly free market would actually benefit developing world farmers because, by removing support for developed world farmers it would make the former more competitive and lead to higher rather than (as is now the case) artificially depressed prices. This in turn would enable poor countries to earn foreign exchange which could then be invested in developing other more profitable sectors of the economy, such as the manufacturing and services industries. They also point out that environmentalists cannot 'have it both ways'; they cannot complain that the current trade system does not allow the developing world to compete effectively and at the same time argue that no one should be trading at all.

Local food is not a sufficient priority for consumers:

Supermarkets and manufacturers merely give people what they want and market research suggests that the provenance of food plays little part in most people's shopping decisions. Most people want a wide range of food that is convenient to prepare and any retailer who doesn't provide it will go out of business. Supermarkets have grown in power because they provide this convenience at low cost. To meet customers' demands for such food, and at a cost which is acceptable to the consumer and

financially viable for the retailer, the latter has to source from wherever it is available. It is also the case that, where there is demand for local foods, supermarkets have also been active in sourcing and providing them. Most local shops rely as heavily on internationally sourced foods as the supermarkets.

The past was not a pretty place: Poor quality food was a fact of life in the past. We are now healthier than ever before and much of this is thanks to a better diet. Life expectancy in the UK has increased and is continuing to do so, we are growing taller and babies are born with higher birthweights – all signs of good nutrition. While some nutrition-related illnesses are increasing (such as heart disease, strokes and diabetes) others also caused by poor nutrition, including rickets and scurvy, are on the decline.

Supermarkets are responding to our changing nutritional needs by developing healthier options, both of the 'Be good to yourself' variety and through the provision of fresh fruit and vegetables, often in forms which make it easier for people to make healthier choices.

Localisation is not practically achievable: We cannot grow everything we need locally and we never have been able to. There has always been trade between regions, countries and continents. Even where some food can be supplied locally, it may not be sufficient to meet demand or consumer expectations of quality and price, and there will always be seasonal shortfalls. Sourcing some produce locally and some from further afield, while achievable, could lead to the development of two supply chains and arguably more environmental damage.

Logistically it wouldn't work: The existing system, whereby supplies are delivered to a regional or national distribution depot, consolidated with other products, loaded to maximum capacity onto an efficient heavy goods vehicle and delivered to store, with good use made of the return journey through the backhauling of packaging or a pick-up from a supplier, is highly efficient. The alternative – half-empty, far less efficient vans delivering direct to store, without interim consolidation – is not. Shelves would be half empty, congestion would worsen and greenhouse gas emissions would rise.

Glossary

Backhauling: Backhauling in its simplest form means that a retailer's vehicle collects goods from local suppliers after making a delivery to store, the aim being to eliminate empty (and therefore profitless) vehicle journeys. However, advanced Information and Communications Technology (ICT) has enabled backhauling systems to become increasingly sophisticated in the complexity of the routes they take, in their flexibility to change plans (for instance to detour a traffic jam) and in the functions they perform. Where a third-party logistics provider is involved, backhauling operations may span a variety of different sectors. For instance a 3PL may deliver a shipment of goods to a car plant and then, on the return leg, collect goods from local food suppliers.

Corporate social responsibility: The Department of Trade and Industry offers the following definition of a socially responsible corporation: *'It recognises that its activities have a wider impact on the society in which it operates. In response it takes account of the economic, social, environmental and human rights impact of its activities across the world and it seeks to achieve benefits by working in partnership with other groups and organisations.'*⁴⁰¹ Unison Scotland notes that *'CSR in its most complete sense would permeate all core and non-core activities, creating an intrinsic link between ethics and the actions of the company/organisation/body.'*⁴⁰²

Due Diligence: Most trade and consumer laws are subject to 'strict liability'. A party who contravenes these laws is culpable even if there is no guilty intent or knowledge on their part. However a defence, on the grounds of Due Diligence, is available if the party charged can show there was an effective system in place designed to ensure that all 'reasonable steps' were taken to prevent the offence being committed, and 'Due Diligence' was exercised to ensure that the system was effectively managed.

Efficient consumer response: An initiative set up by the food industry, with the aim of 'working together to meet consumer needs better, faster and at less cost'.

Embodied energy: The total energy involved in the production of food from raw materials to finished product.

Factory gate pricing: Suppliers and retailers agree a price for the goods which excludes the cost of transport. Traditionally transport costs have been included in the manufacturer's price. By establishing a

factory gate price the retailer is able to review the importance of transport relative to the end price of the product. The retailer can look at ways of improving transport efficiency and compare prices between manufacturers. On many occasions this may mean that retailers pick up goods direct from the manufacturer, instead of receiving deliveries from the manufacturers into their (the retailers') RDCs. On the way to the manufacturer, retailers can make use of the empty outward journey by dropping off goods to a store, returning packaging for recycling and so forth, so removing the need for a separate journey.

Food industry: The term includes farmers, processors, manufacturers and retailers of all sizes.

Food miles: A phrase used to encapsulate concerns about the increasing distances our food travels, and the environmental and social consequences thereof.

Goods lifted: The actual tonnage of goods carried.

Goods moved: See tonne-kilometres.

Intergovernmental Panel on Climate Change (IPCC): A body established by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all members of the UN and of the WMO.

Inventory: The amount of goods in the supply chain.

Just in time (JiT): Definitions abound. One defines it as *'the principle that goods are delivered at the right quantity at the right place immediately in advance of their requirement.'*⁴⁰³ Another calls it a philosophy as much as a technique, *'based upon the simple idea that wherever possible no activity should take place in a system until there is a need for it. Thus no products should be made, no components ordered, until there is a downstream requirement.'*⁴⁰⁴

401 *Business and Society: Corporate Social Responsibility report 2002*, Department of Trade and Industry, London, May 2002, www.societyandbusiness.gov.uk/pdf/2002_report.pdf

402 See: www.unison-scotland.org.uk/briefings/csrethicsbrief.html

403 Hall D and Braithwaite A, *The Development of Thinking in Supply Chain and Logistics Management*, chapter in Brewer A, Button D and Hensher D, (eds) *Handbook in Transport 2: handbook of transport, supply chain and logistics*, Pergamon, UK, 2001

404 Christopher M, *Logistics and Supply Chain Management: strategies for reducing cost and improving service*, Financial Times/Pitman Publishing, UK, 1998

Locality: this is food from a specific provenance which is distributed widely. For instance Somerset Brie is available across the UK. Locality food is an issue more related to branding and marketing than to transport distance.

Locally sourced or local food: Food whose main ingredients are grown, processed and sold from or within a given radius. The Campaign to Protect Rural England and Waitrose limit this radius to 30 miles; others may adopt a county-wide or less rigid definition. Few, if any, organisations take into account inputs such as agricultural machinery, although many would endorse local sourcing of these where possible.

Locally focused or more local systems are approaches which favour sourcing from nearer to hand rather than from national or international sources. It is a relative, non-prescriptive term and could in some cases mean sourcing a product from France rather than from California.

A **local store:** An independently owned shop or a member of a symbol group or co-operative. Many multiple-owned store formats, such as Sainsbury's Local or Tesco Metro are also 'local.' However, their distribution systems are linked in with those of the retailers' bigger store formats and will be similar, if not identical to them. For the purposes of this study, and to differentiate clearly between systems to be explored, we do not include these multiple-owned local stores in this definition. We occasionally use the phrase **independently-owned store** to clarify the distinction.

Lower carbon food: A system focused on delivering lower carbon food is one which attempts to source, produce and supply food in ways that minimise carbon emissions. The ultimate objective is to achieve an absolute CO₂ reduction along the whole of the food supply chain, from plough to plate to landfill site, in keeping with IPCC (see above) recommendations. Strategies to minimise CO₂ impacts from transport (including the *shorter-plus* approach, defined below) will be balanced against those which focus on reducing other life-cycle emissions.

Local consolidation point (LCP): A small centre where goods from the local area can be consolidated before continuing on their journey, either direct to a store or to a RDC.

Payload: The revenue producing part of a cargo – in other words, the goods being carried rather than the weight of the vehicle.

Radiative forcing: The change in the balance between solar radiation coming into the atmosphere and infra-red radiation going out. Positive radiative forcing tends on average to warm the surface of the Earth, and negative forcing tends on average to cool the surface. The addition of greenhouse gases traps infra-red radiation, re-radiating it back toward the surface and creating a warming influence.

Regional food: Food from a catchment area such as the North-West, or Wales.

Regional distribution centre (RDC): The supermarkets each own a number of large warehouses or RDCs strategically located across the UK. The RDCs receive goods from consolidation points and from manufacturers, both from within and beyond the region. Goods are consolidated onto lorries and then delivered to stores.

Shorter-plus supply chains: An approach in which there is a deliberate attempt to shorten the supply chain, taking into account and balancing geographical distance against other transport-related factors with a bearing on CO₂. This approach strikes a balance between the differences in emissions from different modes of transport (rail, sea, road, air) as well as different types of road vehicle, loading factors, route and so forth.

State aids: A form of assistance given by the state to an enterprise or sector. State aid comes in many different forms (not just as subsidies or grants) and no single definition will apply to all its manifestations. The European Commission is, however, very clear that any form of aid – whether provided directly by the state or indirectly through 'state resources' – is incompatible with the Common Market if it distorts or threatens to distort competition within the Community.

Third-party logistics provider (3PL): A specialist in logistics who provides a number of services. These include managing fleets and warehouses for retailers or manufacturers. Sometimes the 3PL uses its own warehouses and vehicles and sometimes it uses those belonging to the client.

Tonne-kilometres: A measure of freight, based on multiplying the weight of the load and the distance through which it is hauled. For instance a weight of 26 tonnes carried 100 kilometres represents 2600 tonne-kilometres.

Vehicle-kilometres: A measure of freight, based on multiplying the number of vehicles by the distance they travel. For instance ten vehicles each moving 100 kilometres represent 1000 vehicle-kilometres.



The CENTER for AGROECOLOGY
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Center for Agroecology and Sustainable
Food Systems
UC Santa Cruz

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Community Supported Agriculture on the Central Coast: The CSA Member Experience

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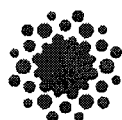
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Abstract:

This Research Brief details the experiences of Community Supported Agriculture (CSA) members in the California central coast's 5-county region: who and why they joined a CSA, their connection to farmers, reasons for staying with or leaving the CSA project, and the impact of the CSA on their eating habits and on their awareness of agricultural and environmental issues.



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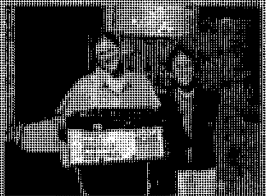


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RESEARCH

BRIEFS



Research
Brief #1

Community Supported Agriculture on the Central Coast: The CSA Member Experience

In recent years, both growers and consumers have become increasingly interested in direct marketing as an alternative to conventional marketing outlets. Further, as more consumers develop an appreciation for fresh food produced close to home, they're turning to farmers markets and other direct markets that offer not only locally grown food, but a connection with those who grow it.

In the search for alternatives to the current food system, Community Supported Agriculture (CSA) offers an increasingly popular option. In the CSA arrangement, consumers get much of their weekly produce by picking up a box of organic, fresh-picked fruits and vegetables grown on a farm in their community. A farmer commits to growing food for a group of people (often called "members" or "shareholders"), and the people support the farmer by paying for their shares of produce ahead of time, often at the beginning of the season. CSA members thus ideally share both the risks and the bounty of farming.

Although community supported agriculture farms have only been operating in the U.S. since the mid 1980s, there are now between 800 and 1,000 CSAs in the United States. As CSAs have proliferated in this country and elsewhere, CSA and sustainable agriculture advocates have professed a number of hopes and dreams for this approach to farming and marketing. Many see CSA as a vehicle for increasing small farm viability and for encouraging the use of ecologically sound farming practices. CSAs have also been promoted as a way to connect people to their food and each other by building personal relationships between farmers and consumers, as well as by educating people about the food system and its issues.

In 2001, the social issues staff of the Center for Agroecology and Sustainable Food Systems (the Center) at UC Santa Cruz initiated a study of California central coast CSAs,

covering Monterey, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties. This research aims to: 1) describe how the CSA model has been implemented on the central coast, 2) determine the extent to which CSAs on California's central coast are manifesting the hopes that people hold for them, and 3) identify constraints and opportunities to reaching these ideals. The project was designed to contribute to the small number of studies focusing on CSAs in California, and to provide information to people interested in understanding, supporting, or furthering CSAs.

This research brief focuses on one aspect of the CSA study: the profiles and experiences of CSA members. Member attitudes, experiences and perceptions are summarized, and then used to explore the extent to which CSAs are meeting the ideals that many hold for them (to make farming viable and ecological, as well as to encourage connection to and learning about the food system) and to identify some opportunities and challenges that they face in meeting these goals.¹

RESEARCH APPROACH

The research team—post-graduate researcher Jan Perez, social issues specialist Patricia Allen, and post-doctoral researcher James Murrell—used three strategies for collecting information about CSAs: interviews, written questionnaires, and focus groups. Center social issues staff conducted 1 1/2- to 3-hour interviews with growers from 12 of the 14 CSAs identified on the central coast. These growers also completed a questionnaire covering information such as farm size, growing practices, and demographic data.

CSA members provided information through a written questionnaire and by participating in focus groups. A 4-page survey was distributed to members of 8 farms through the mail or in the CSA box. Of the 638 surveys delivered to members, we received 274 responses for a response rate of 43%.²

Community Supported Agriculture on the Central Coast

On a form delivered with the questionnaire, members were asked to indicate if they would be interested in participating in a focus group on CSA. Ultimately, 17 members from 5 different farms were able to participate in one of three focus group sessions that took place in several central coast locations.

WHO JOINS CSAS?

In 2001, we estimated that around 4,900 people (approximately 0.2% of this regions population) regularly received food from one of the 14 CSAs in the five-county central coast region. Our survey results suggest that these members are very similar to other CSA shareholders nationwide: they tend to be European-American (90%), highly educated (81% have 16 or more years of education, equivalent to a college degree), and middle-to-upper income (66% have a household income of \$60,000 or more). Members represent a relatively narrow proportion of the central coast population, where only 51% of the people are European-American and the median income for most central coast counties is below \$45,000. Thus, it appears that central coast CSAs are currently serving a specific demographic profile.

Our research also reveals that many members who joined CSAs in 2001 were new to this activity. Forty-one percent were first-time members. Slightly more than 20% have been members for 4 years or more, implying that not many people have stayed members of CSAs for the long term.

WHY DID PEOPLE JOIN?

The survey asked members to write in their most important reasons for joining the CSA. As shown in table 1, the most frequently reported "important reasons" members expressed were to purchase organic³ (62%), fresh (34%) produce. The members also wanted to buy local produce or support "local" (40%).

When focus group members were asked why they wanted to "support local," several themes were mentioned. Some people felt that local farms benefit the community in some way, such as by adding jobs, green space, and diversity. Other reasons mentioned include that local farms allow for connection—to the farmers, other people, the land, or farming itself. Finally, others think that supporting local is more ecological, in that less resources are used shipping the food to distant outlets, and having a farm nearby allows people to make sure their farmer is actually using ecological farming methods.

Social issues research on CSAs is part of the Center's Central Coast Research Project, an effort funded by the US Department of Agriculture. The project explores ways to improve the sustainability of the food and agricultural system on the California central coast. Also included in the Central Coast study is research on water quality and ways of decreasing nonpoint source pollution from the region's farms.

Table 1. Most frequently listed *most important* reasons for wanting to become a CSA member.*

Response Categories	N	%
organic produce	170	62%
support or buy local	110	40%
fresh produce	94	34%
support organic (farms/farmers/agriculture)	44	16%
quality produce	39	14%
convenience	39	14%
support small or family farms/farmers	28	10%
health	26	10%
variety	26	10%
good price/value	23	8%
support sustainable agriculture	20	7%
eat seasonally	20	7%
know how/where food was grown	19	7%
other	28	10%

*Only categories with more than 5% of members endorsing them were listed. 255 people (out of 274) who responded to this question. 19 surveys (7%) had no response. All answers were coded, and there was an average of 3.08 reasons listed for each respondent.

Considering that several of the primary reasons given for becoming a CSA member could also be met by going to the farmers market, focus group members were asked what they receive by participating in a CSA rather than by shopping at a farmers market. Although not everyone participated in a CSA to the exclusion of farmers markets, there were still themes regarding their preference. Convenience was frequently mentioned by focus group members—that CSA is less work than going to the farmers market. Some preferred CSA because it allowed them direct contact to a farm, which, as one member said, is "... much different than going to a farmers market and just seeing the produce on the table—you see ... the whole process." Others mentioned that it helped support eating habits that they wanted to have. These responses show some of the unique aspects of CSA, and offer insights for promoting this new aspect of the food system.

HOW DISTANT ARE PEOPLE FROM THEIR FOOD SOURCE?

One goal of CSAs is to shorten the distance between consumers and the source of their produce as a way to save energy on transportation (some estimates for the average distance fresh produce travels range from approximately 1,100 miles to 1,700 miles⁴).

Our results confirm that central coast members are close to their farms and their pick-up sites. Respondents live an average of 19 miles from the farm, and close to half (45%) live less than 3 miles from their pick-up site. This finding suggests that CSAs may be meeting their goals of providing a more ecological alternative to the current food system, by helping to cut down on the resources used for food transportation.

ARE MEMBERS CONNECTING WITH FARMERS?

One hope of some CSA advocates is that members will connect with farmers and the farm from which they get their food. The survey results show that 60% of the respondents have been to the farm at least once in the past year, implying that some form of connection is taking place. However, only 34% had been to the farm on a regular basis (this number includes those who pick up their share at the farm, and members who have visited 6 or more times on their own). Additionally, only 5% of the respondents reported doing any work for the CSA in the past year. Thus, while there is clearly a connection between some farmers and some members, central coast CSAs do not appear to achieve the ideal of close working connections between farmers and members.

HOW DOES CSA MEMBERSHIP AFFECT HABITS AND ATTITUDES?

One goal of this study was to see how people's habits around shopping and cooking changed as a result of joining a CSA. We assumed that CSA membership would create another task for people; in addition to picking up their weekly share, they would still have to go to the store for food that the CSA did not supply (generally, everything but produce) as well as process the food. Interestingly, we found that half (52%) of the respondents' households reported that they spent *less* time obtaining food after becoming members than they did before joining. Based on our conversations with CSA members, it is possible that they actually spend more time, but that it 'feels' like less. On the other hand, most people (59%) reported that they spent more time preparing food than they did before, since CSA produce is usually minimally processed. Participating in a CSA appears to decrease the amount of time spent on some food-related household tasks while increasing the time spent on others.

Changes in eating habits was another area we explored. Survey results show that 81% (221 individuals) said that they had some type of eating habit change; 79% of the 221 noted that they eat more vegetables or eat a greater variety of vegetables. This finding is encouraging since eating more fruits and vegetables, including a wider variety, has been suggested as a sound way to address and prevent health problems. The next most frequently cited eating habit changes are behaviors related to better health. Shareholders noted that they are eating healthier (18%), eating at home more and out less (11%), and eating better quality food (10%). Focus group participants partially explained this phenomena. The CSA structure helped to support these types of eating habits: for example, some people felt compelled to eat the produce that they had already paid for, and others just couldn't stand throwing vegetables away.

We also wanted to identify what people learned from their experiences with the CSA farm, and how their lives changed. We asked members if there have been any other

changes (besides changes in eating habits) in their own or their household's life since participating in CSAs. The most frequent responses were that people cook differently (27% of the 133 responses). This includes people who say they now plan their meals around the vegetables, cook more creatively, enjoy cooking more, and use different recipes/try new things. As one woman said, "I usually plan a week's menu in advance of going shopping. With CSA I planned the menu around the CSA produce, e.g., ate more stuffed chard and cabbage, fruit desserts, etc."

Some members also noted that they now have a connection with the farm or the farmers (16% of the 133), that they are more aware of agricultural or environmental issues (12%), and that they are more active regarding agricultural issues (11%). These effects—learning more about the food system, and doing something to improve it—are changes that some CSA advocates hope will take place as a result of CSA membership. Although the numbers are low, CSA participation does appear to lead to an increased awareness of food system and environmental issues.

WERE CSA MEMBERS SATISFIED WITH THEIR EXPERIENCE?

What did central coast CSA members think about their experience? Most appeared generally satisfied. Satisfaction among members is very high regarding the quality of the CSA products (71% were "very satisfied"). This is a common finding among other CSAs across the nation. Satisfaction with quantity of produce had the second highest rates: 41% found the quantity to be "just right." Similar to members in other locations across the U.S., CSA members were least satisfied with the product mix (only 24% said they were "very satisfied").

CSA member reaction is important, particularly as it relates to member retention. Encouragingly, 78% said they would return to the CSA next season. However, this finding may be optimistic, since the average return rate farmers reported was around 65%. Some farmers stated that they have to do a fair amount of work every year to replace the members who did not re-join.

WHO STAYS AND WHO LEAVES?

Since a stable marketing channel is important for farmers' economic viability, it is important to know why people leave. When we asked people why they did not plan to re-join the CSA, issues around choice was the primary reason given. The survey found that two-thirds (out of 57 households) of those who did not intend to renew their CSA membership or who were unsure about returning, mentioned something that related to choice or the lack of it. This includes the 44% who gave reasons for leaving that related to product mix. Their comments included, "I really prefer to select my own mix of vegetables" and "[I/we] did not like some of items which we consistently got—kale/chard/ beets."

Other responses related to choice include the 37% who said they had problems with quantity (got too much food, threw away too much, have a hard time finding people to split the share with, etc.). After choice, people cited reasons unrelated to their CSA experience (e.g., loss of income in the household, moving away from the area, or planning to have their own garden). Other reasons are listed in Table 2 below.

Table 2. Reasons why CSA members might not, or will not, renew their membership.*

Response Categories	N	%
product mix issues (more variety, want to select own)	25	44%
problems with quantity (threw out too much, etc.)	21	37%
household issues (moving, don't cook, etc.)	15	26%
cost/value issues	8	14%
pick-up issues	8	14%
problems with quality	5	9%
problems processing and storing	2	4%
prefer farmers market	3	5%
other	6	11%

*There were 55 people who responded to this question (out of the 57 who stated they would or might leave). All responses per survey were coded, and there was an average of 1.75 reasons listed for each respondent.

In addition to exploring why members may leave, we also looked at factors that are related to returning to the CSA. Respondents appeared more likely to re-join when they were satisfied with the quality, quantity, and product mix of the produce; when picking up the box was convenient; and when people felt the share price was fair. Also, members were more likely to return the next year if the payment schedule did not pose a financial hardship, and they were not throwing away or composting more produce than before they joined the CSA.

One interesting finding is that those who said they or their household experienced a change (in eating habits or in some other area of their lives) as a result of participating in a CSA were also more likely to rejoin. For example, 82% of households that experienced a change in eating habits would sign on again, whereas 65% of those without such a change were not likely to rejoin. It appears that learning to incorporate or adapt to the new way of eating and cooking helps increase the likelihood of staying with the CSA, as well as encouraging desirable/valuable lifestyle changes.

WHAT ARE THE IMPLICATIONS OF THESE FINDINGS?

The CSA member survey and focus group findings reveal both positive results and future challenges for those running CSAs or growers who are considering starting a CSA. On the positive side, CSA farms have succeeded in producing high quality produce, have helped people develop healthier eating habits, appear to have addressed some ecological issues (fuel consumption and chemical usage), and have connected some people back to their food source.

Conversely, the data point to several challenges, particularly regarding long-term CSA viability. Addressing the issue of choice appears to be a persistent dilemma. Most people leave the CSA due to lack of choice, yet the idea of "receiving what is available when it is available" is an integral part of the CSA concept. Therefore, turnover is likely to always be an issue, and thus finding new members will continually be required. Some people look at the small number of members currently participating in CSA and see a huge untapped market. However, there are also several indicators that point to obstacles to CSA growth. The limited demographics of people participating, the availability of organic food from other sources (farmers' markets and natural food stores, which are especially prevalent on the central coast), a culture based on convenience and choice, and having to spend more time preparing food and eating what is seasonally available could limit the number of potential members available for both current and future CSAs.

Ultimately, it appears that while CSA is not a quick answer to problems in the food system, it definitely offers a needed alternative. Providing fresh, local, and organically grown produce; a connection to where food is grown; and education about agricultural and environmental issues are important and necessary services for those seeking options in today's food system.

— JAN PEREZ, PATRICIA ALLEN, MARTHA BROWN

¹ Additional aspects of the CSA study, including farmer interviews, will be discussed in future Research Briefs.

² It is not known if the survey results are representative of all CSA members in the central coast region. It is possible that people who responded to the survey are more supportive of CSA.

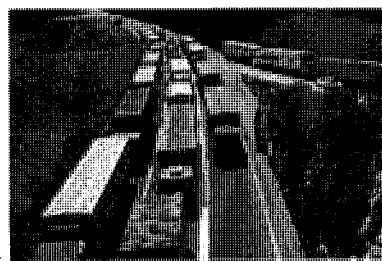
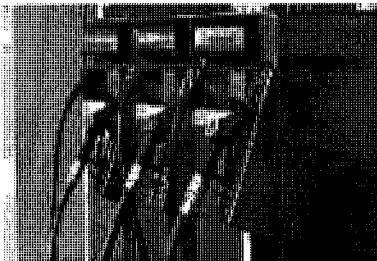
³ 100% of the 12 farms interviewed claimed to be organic (67% certified). As would be expected, 100% did not use any type of synthetic pesticide or herbicide.

⁴ Pirog, R., T. Van Pelt, K. Enshayan, and E. Cook. 2001. Food, fuel, and freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions. Ames, Iowa: Leopold Center for Sustainable Agriculture. www.leopold.iastate.edu/pubinfo/papersspeeches/food_mil.pdf. Accessed on 2002/11/15.

The Center for Agroecology & Sustainable Food Systems (CASFS) is a research, education, and public service program dedicated to increasing ecological sustainability and social justice in the food and agriculture system. Located at the University of California, Santa Cruz, CASFS collaborates with growers, researchers, policy makers, non-governmental organizations, and others on research projects to promote sustainable farming and food systems. This Center Research Brief is part of a series reporting on CASFS research efforts. For more information on the research covered in this Brief, or on the Center's activities, contact us at CASFS, 1156 High St., University of California, Santa Cruz, CA 95064 831.459-3240. www.ucsc.edu/casfs.

Food, Fuel, and Freeways:

**An Iowa perspective on how far food travels,
fuel usage, and greenhouse gas emissions**



by

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Executive Summary

Most consumers do not understand today's highly complex global food system. Much of the food production and processing occurs far away from where they live and buy groceries. External environmental and community costs related to the production, processing, storage, and transportation of the food are seldom accounted for in the food's price, nor are consumers made aware of these external costs. Examples of external environmental costs are the increased amount of fossil fuel used to transport food long distances, and the increase in greenhouse gas emissions resulting from the burning of these fuels.

Local and regional food systems, where farmers and processors sell and distribute their food to consumers within a given area, may use less fossil fuel for transportation because the distance from farm to consumer is shorter. This paper discusses transportation from farm to point of sale within local, regional, and conventional food systems. Using fresh produce and other foods as examples, we considered miles traveled, fossil fuels used, and carbon dioxide emissions, and assessed potential environmental costs.

A food mile is the distance food travels from where it is grown or raised to where it is ultimately purchased by the consumer or end-user. A Weighted Average Source Distance (WASD) can be used to calculate a single distance figure that combines information on the distances from producers to consumers and amount of food product transported. U.S. Department of Agriculture Agricultural Marketing Service produce arrival data from the Chicago, Illinois terminal market were examined for 1981, 1989, and 1998, and a WASD was calculated for arrivals by truck within the continental United States for each year. Produce arriving by truck traveled an average distance of 1,518 miles to reach Chicago in 1998, a 22 percent increase over the 1,245 miles traveled in 1981.

A WASD was calculated for a sampling of data from three Iowa local food projects where farmers sold to institutional markets such as hospitals, restaurants, and conference centers. The food traveled an average of 44.6 miles to reach its destination, compared with an estimated 1,546 miles if these food items had arrived from conventional national sources.

Would there be transportation fuel savings and reduction in carbon dioxide (CO₂) emissions if more food were produced and distributed in local and regional food systems? To answer this question, we calculated fuel use and CO₂ emissions to transport 10 percent of the estimated total Iowa per capita consumption of 28 fresh produce items for three different food systems. A number of assumptions were used regarding production origin, distance traveled, load capacity, and fuel economy to make the calculations. The goal was for each of the three systems to transport 10 percent by weight of the estimated Iowa per capita consumption of these produce items from farm to point of sale.

The *conventional* system represented an integrated retail/wholesale buying system where national sources supply Iowa with produce using large semitrailer trucks. The *Iowa-based regional system* involved a scenario modeled after an existing Iowa-based

distribution infrastructure. In this scenario a cooperating network of Iowa farmers would supply produce to Iowa retailers and wholesalers using large semitrailer and midsize trucks. The *local system* represented farmers who market directly to consumers through community supported agriculture (CSA) enterprises and farmers markets, or through institutional markets such as restaurants, hospitals, and conference centers. This system used small light trucks.

The conventional system used 4 to 17 times more fuel than the Iowa-based regional and local systems, depending on the system and truck type. The same conventional system released from 5 to 17 times more CO₂ from the burning of this fuel than the Iowa-based regional and local systems.

Growing and transporting 10 percent more of the produce for Iowa consumption in an Iowa-based regional or local food system would result in an annual savings ranging from 280 to 346 thousand gallons of fuel, depending on the system and truck type. The high end of this fuel reduction would be equivalent to the average annual diesel fuel use of 108 Iowa farms. Growing and transporting 10 percent more of the produce for Iowa consumption in an Iowa-based regional or local food system would result in an annual reduction in CO₂ emissions ranging from 6.7 to 7.9 million pounds, depending on the system and truck type.

These fuel savings and CO₂ reductions may seem small when considering total fuel use and CO₂ emissions in Iowa, but our estimates represent less than 1 percent of total Iowa food and beverage consumption by weight (not including water). If a higher percentage of other foods and beverages were grown and/or processed in Iowa, the reduction in fuel use and CO₂ emissions from food transport would undoubtedly be much greater.

This paper shows that fresh produce transported to Iowa consumers under the current conventional food system travels longer distances, uses more fuel, and releases more CO₂ than the same quantity of produce transported in a local or Iowa-based regional food system. Given that fuel expenses are only a small percentage of total transportation and distribution costs, however, fuel energy costs will need to rise significantly if they are the only factor considered in determining whether local and regional systems are economically competitive with the conventional system. Economic value must be assigned to the external environmental cost of burning more fossil fuels and releasing more CO₂. The authors strongly urge that more baseline research be conducted comparing the energy efficiency and external environmental costs of production, processing, packaging, and transportation sectors of conventional, regional, and local food systems.

Introduction

A food system includes the production, processing, distribution, sales, purchasing, preparation, consumption, and waste disposal pathways of food. In Iowa and across the nation, the level of interest in local and regional food systems – where local farmers sell their products to nearby consumers – is growing. One example of a local food system is community supported agriculture, which establishes a partnership between farmers and consumers. In a typical Iowa community supported agriculture (CSA) enterprise, consumers pay a given amount to a farmer or group of farmers before the start of the growing season, sharing in some of the risk of producing the food. The food is then delivered directly to the consumer or is picked up at a designated location. Other examples of local food systems include farmers markets, roadside stands, on-farm sales, pick-your-own operations, production/processing/retail enterprises, and sales to hotels, restaurants, bed and breakfast inns, and institutions.

Most consumers do not understand the current national and global food production system, in which most of the food production and processing occurs far away from where they live and buy their groceries. Yet an increasing number of consumers have shown an interest in locally or regionally produced foods. Researchers at Oregon State University surveyed both working class and more affluent community residents in the Portland area and found that 44 percent of residents in both groups expressed moderate to strong support for buying local products.¹ Practical Farmers of Iowa recently interviewed Iowa wholesale food distributors, retail store managers, chefs, institutional food service managers, and cooperative buyers as part of a Leopold Center-supported project. All of the representatives expressed an increased interest in buying Iowa-grown meat and produce to satisfy rising consumer demand, and also agreed that there is a small but expanding market for organically or sustainably grown products.²

In the past 30 years there has been a significant global increase in fossil fuel use. One reason for the rise in U.S. fossil fuel use is the increased use of trucks to transport goods. In 1965, there were 787,000 combination trucks registered in the United States, and these vehicles consumed 6.658 billion gallons of fuel.³ In 1997, there were 1,790,000 combination trucks that used 20.294 billion gallons of fuel.⁴ Many of these trucks transport food throughout the United States. A recent study indicated that in California alone more than 485,000 truckloads of fresh fruit and vegetables leave the state every year and travel from 100 to 3,100 miles to reach their destinations.⁵

¹ Stephenson, Garry and Larry Lev. *Oregon State University Extension Service*. Portland, OR, Oregon State University. September 1998.

² Practical Farmers of Iowa "Grocery and Hotel, Restaurant and Institution Study." April, 2000. Scanlan & Associates in cooperation with Gary Huber and Robert Karp.

³ U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 1997.

⁴ *ibid.*

⁵ Hagen, J.W., D. Minami, B. Mason, and W. Dunton. 1999. "California's Produce Trucking Industry: Characteristics and Important Issues." Center for Agricultural Business, California Agricultural Technology Institute, California State University – Fresno.

The predicted peak in world oil production, according to petrogeologists and other oil experts, will occur in 5 to 20 years.^{6 7} After that time oil increasingly will be more expensive to obtain. Yet projections are for motor gasoline and diesel fuel demand to increase 1.4 and 2.3 percent per year, respectively, through the year 2020.⁸

The burning of these fossil fuels releases carbon dioxide (CO₂) and other gases known as greenhouse gases that absorb heat and may contribute to an increase in global warming. Considering all sectors of the economy, Iowa emits 29 tons of carbon dioxide annually on a per capita basis.⁹ Total U.S. greenhouse gas emissions in 1999 were 11.6 percent higher than 1990 emissions.¹⁰ The largest source of CO₂ and overall greenhouse gas emissions in the United States was fossil fuel combustion, accounting for 80 percent of global warming potential (GWP)¹¹ -weighted emissions in the 1990s.¹²

Estimates suggest that a doubling of atmospheric carbon dioxide will result in an increase of 4.5° F in the planet's average annual temperature.¹³ Recently the Intergovernmental Panel on Climate found stronger evidence of the human influence on climate change. According to the scientists' estimates, earth's average surface temperature could be expected to increase by 2.7° F to nearly 11° F by the end of this century if greenhouse emissions are not curtailed.¹⁴ The Kyoto Global-Warming Accord Treaty,¹⁵ signed by the United States in 1998, calls for industrial countries to achieve a 5.2 percent reduction of heat-trapping greenhouse gases from 1990 levels. The United States, the world's largest emitter of greenhouse gases, would have to make cuts of seven percent.¹⁶ In late March 2001, the Bush administration opposed the Kyoto Accord on the grounds that ratification would put an unfair burden on the United States and damage the economy.¹⁷ Efforts to

⁶ Richard A. Kerr. "The Next Oil Crisis Looms Large – and Perhaps Close." August 21, 1998. *Science* 281: pp. 1128-1131.

⁷ Duncan, R.C. 2001. "World energy production, population growth, and the road to Olduvai Gorge." *Population and Environment* 22(5): 503-522.

⁸ Annual energy outlook forecasts of average annual growth in transportation energy demand (percent) Web site April 2001 (<http://www.eia.doc.gov/oiaf/aco/tbl24.html>).

⁹ Ney, R.A., J.L. Schnoor, N.S.J. Foster, and D.J. Korkenbrock. 1996. "Iowa Greenhouse Gas Action Plan." Report prepared for the Iowa Department of Natural Resources by the Center for Global and Regional Environmental Research Public Policy Center, University of Iowa.

¹⁰ U.S. Greenhouse Gas Emissions and Sinks: 1990-1999. 2001 (Draft). pp. ES-1. EPA. Web site May 2001 (<http://www.epa.gov/globalwarming/publications/emissions/us2001/2001-inventory.pdf>).

¹¹ The concept of a global warming potential (GWP) has been developed to compare the ability of each greenhouse gas to trap heat relative to another gas. Carbon dioxide was chosen as the reference gas for the GWP.

¹² U.S. Greenhouse Gas Emissions and Sinks: 1990-1999. 2001 (Draft). pp. ES-1. EPA. Web site May 2001 (<http://www.epa.gov/globalwarming/publications/emissions/us2001/2001-inventory.pdf>).

¹³ Gale Group Web site February 2001. (<http://www.gale.com/freresrc/earthday/2000/greenhs.htm>).

¹⁴ Herbert, H. Josef. "Global warming fears grow." *Des Moines Register*, October 26, 2000.

¹⁵ The Kyoto Global Accord Treaty calls for sharp reductions in heat-trapping greenhouse gases by the United States and 37 other industrial nations.

¹⁶ Herbert, H. Josef. "Delay Sought in Climate Talks." Lycos News. January 24, 2001. Web site March 2001 (http://news.lycos.com/head_article.asp?docid=APVO695&date=20010124).

¹⁷ "The World Can't Wait for Another Climate Treaty." Worldwatch Institute News Release. Worldwatch Institute Web site April 2001 (<http://www.worldwatch.org/alerts/010328.html>).

persuade the United States to endorse the Kyoto Accord at the European Union/United States summit in June 2001 ended in stalemate.¹⁸

Certain states, regions, and countries are said to have “comparative advantages” to producing food at the cheapest possible cost. But external environmental and social costs related to food production, processing, storage, and distribution are seldom accounted for in the price of the food.¹⁹ It is argued that if these costs were internalized, such “comparative advantages” would be significantly reduced or eliminated entirely. Examples of environmental external costs are the increased amount of fossil fuel used to transport food and the increase in greenhouse gases emitted as the result of the burning of those fuels. One likely advantage to local and regional food systems is the reduced distance that the fresh or processed food travels from farm to point of sale. Shorter transportation distances may mean less fossil fuel is burned and fewer greenhouse gases are released into the atmosphere.

Using fresh produce and other foods as examples, this paper will discuss transportation and distribution within local, regional, and conventional food systems, determining miles traveled, fossil fuels used, and greenhouse gases released.

Objectives

1. Provide a brief overview of the changes in Iowa's food system.
2. Provide an overview of the research on energy use in the food system, with emphasis on the transportation/distribution sector.
3. Using several global, Iowa, and Midwest examples, discuss the distances that food travels (from farm to point of sale) and compare distances between local and conventional systems.
4. Using fresh produce as an example, compare miles traveled, fossil fuel used, and carbon dioxide emitted in the transport sector of several food systems.
5. Make recommendations for action (for consumers, farmers, food retailers and brokers, researchers and educators, and policy makers) to document external costs regarding fossil fuel energy use in the conventional food system, reduce transportation-related fuel use and CO₂ emissions in food systems, and examine potential benefits of local and regional systems.

¹⁸ “Summit admits to Kyoto failure.” *The Guardian*. Guardian Unlimited. Web site June 2001 (<http://www.guardianunlimited.co.uk/international/story/0,3604,507308,00.html>)

¹⁹ Orr, David. 1991. “Understanding the true cost of food: Consideration for a sustainable food system.” Proceedings of the Institute for Alternative Agriculture, Eight Annual Scientific Symposium, Washington, D.C.: Institute for Alternative Agriculture.

Changes in Iowa's food system

Although less than 7 percent of Iowans make their living by farming, Iowa remains a predominantly agricultural state, with approximately 33 million acres of land in farms.²⁰ Table 1, developed by Michael Carolan in the Iowa State University Department of Sociology and based on the U.S. Agricultural Census records, shows the number of commodities produced for sale on at least 1 percent of all Iowa farms from 1920 to 1997. Iowa produced 34 different commodities on at least 1 percent of its farms in 1920, including food crops such as apples, potatoes, cherries, plums, grapes, raspberries, strawberries, sweet corn, and pears. In that same year, ten different commodities were produced on over 50 percent of Iowa's farms.

During the decades following World War II, agriculture became increasingly specialized, with many states focusing their agricultural production on certain crop and livestock enterprises. Using federal and state incentives, Iowa centered its agricultural production on commodities such as corn, soybeans, hogs, and cattle. Table 1 illustrates this decline in diversity; by the 1970s there were no fruits or vegetables produced on at least 1 percent of Iowa's farms. By 1997, only corn and soybeans were produced on over 50 percent of Iowa's farms.

With a decline in production diversity came a decrease in processing of certain crops. According to a 1922 report, Iowa led the world in canned sweet corn production.²¹ In 1924 Iowa processed locally grown sweet corn at 58 canning factories in 36 different counties.²² By 1998 sweet corn and other vegetables were processed at only two Iowa canning facilities.²³

With the possible exception of livestock for meat production, most Iowa farms no longer produce food to supply Iowa consumers directly. The majority of the crops Iowa farmers produce leave the state as raw commodities, and processors add more value before purchase by the consumer or buyer. The change in Iowa's agriculture over time has brought about an increasing reliance on food from outside sources. For example, in 1870 nearly 100 percent of the fresh apples consumed in Iowa were grown in the state. By 1925, roughly 50 percent of the apples consumed were grown in Iowa.²⁴ In 1999, Iowa grew approximately 15 percent of the fresh apples consumed in the state.²⁵ It is assumed that other food items once produced on many Iowa farms have followed a similar pattern of decline.

There is a lack of baseline data on Iowa production and processing used for in-state consumption. In recent years, 10 percent has been used as an estimate of how much of the food Iowans consumed is grown in the state, but this figure is at best only an edu-

²⁰ Iowa Agricultural Statistics, 2000.

²¹ Report of Dairy and Food Commissioner, Iowa. P. 41.

²² Clowes, Harry. 1927. "Fruit and Vegetable Production in Iowa." M.S. Thesis, Iowa State College.

²³ "Food Product Directory of Iowa." 1998. Iowa Department of Economic Development.

²⁴ Clowes, Harry. 1927. "Fruit and Vegetable Production in Iowa." M.S. Thesis, Iowa State College.

²⁵ Pirog, Richard, and John Tyndall. 1999. "Comparing apples to apples: An Iowa perspective on apples and local food systems." Leopold Center for Sustainable Agriculture, Ames, Iowa.

cated guess. A 1985 report estimated that more than 90 percent of Iowa's produce demand is provided for by sources outside of the state.²⁶ The report indicated that Iowa farmers grew a small fraction of the fresh produce bought during the summer months by Iowa produce wholesalers and distributors for sale within the state.²⁷ This purchasing trend holds true in 2001.²⁸

Energy use in the food system

A thorough examination of energy use in the food system is beyond the scope of this paper. An excellent 1996 summary of research and analysis of energy use in the food system, written by John Hendrickson, covers many important studies and is recommended as further background for the reader.²⁹ The gasoline shortages and a perceived energy crisis in the 1970s prompted a number of studies on energy use in the food system. Hendrickson's research points to a critical need to replicate studies performed in the 1970s.

New studies on energy use in all sectors of the food system are needed for a number of reasons. The nation is experiencing serious energy shortages once again, with rising prices and energy blackouts in California and other states. Increased efforts to conserve fossil fuels are being explored at state and federal levels. With increased interest in local and regional food systems, it is important to document whether these systems are more energy efficient than conventional systems, and whether an increased use of such systems will contribute to a reduction in fossil fuel use and greenhouse gas emissions.

Table 2, taken from John Hendrickson's research, averages the findings from nine studies that document energy use in various sectors of the food system.³⁰ The table shows that the food system accounts for almost 16 percent of total U.S. energy consumption, similar to David Pimentel's 1989 estimate of 17 percent. Table 2 also shows that transportation accounted for 11 percent of the energy use within the food system, considerably less than agricultural production (17.5 percent) and processing (28.1 percent).

Energy use by sectors also varies tremendously by the type of food considered. For example, for a one-kilogram loaf of bread more than 70 percent of the energy is used in the production and processing sectors.³¹ For a one pound can of corn, those same two sectors use only 27 percent of the energy, with packaging accounting for over one-fourth

²⁶ Valley, Camille. "Market Conditions for Fresh Fruits and Vegetables in Iowa." April 1985. Des Moines, Iowa: Iowa Department of Agriculture.

²⁷ *ibid.*

²⁸ Comments made by a food service manager with an Iowa produce distribution company, February 2001.

²⁹ Hendrickson, John. 1996. "Energy use in the U.S. Food System: A Summary of existing research and analysis." Sustainable Farming-REAP-Canada. Ste. Anne-de-Bellevue, Quebec. Vol 7, No. 4. Fall 1997.

³⁰ *ibid.*

³¹ Pimentel, David and Marcia Pimentel. 1996. *Food, Energy, and Society*. Niwot, CO: Colorado University Press.

of the total energy used.³² The energy used to transport a one pound can of corn home and to prepare it exceeds the energy needed to produce the corn.³³

Life Cycle Assessment

Life Cycle Assessment (LCA) is a method for performing an integral analysis of the environmental impacts of products in a “cradle to grave” fashion.³⁴ ³⁵ Energy consumption within the life cycle of a product is typically calculated while performing an LCA. The LCA method was originally developed for use with industrial products, but recent research has investigated the extent to which the LCA method is suitable for use in agricultural systems.³⁶ One such study estimated the total life cycle energy consumption of apples and pears to be 23 megajoules per kilogram (MJ/kg).³⁷ (For reference purposes, one MJ will light a 100-watt light bulb for 2.8 hours.³⁸) In another study, the energy needed for a fast food-type hamburger was estimated to be between 24 and 65 MJ/kg.³⁹ Ground beef required the most energy of all food products needed for the hamburger (other products included were bun, lettuce, cheese, pickles, and onions).

Several studies have compared energy consumption for crops grown locally versus those imported. One study found that sourcing fresh peas locally required nearly three times less energy compared to imported peas.⁴⁰ A Swedish study compared the energy consumption of Swedish and imported carrots and found that energy consumption for the imported carrots was double that of the domestic produce.⁴¹

A recent University of Michigan study used an LCA approach to develop and present a broad set of sustainability indicators of the U.S. food system.⁴² The assessed indicators showed that the U.S. food system is not economically, socially, or environmentally

³² Brown, Susan J. and J. Claire Batty. 1976. “Energy Allocation in the Food System: A Microscale View.” *Transactions of the American Society of Agricultural Engineers* 19(4):758-761.

³³ *ibid.*

³⁴ The International Organisation for Standardisation (ISO). 1997. Environmental Management – Life Cycle Assessment: Principles and Framework. International Standard ISO 14040.

³⁵ “Application of LCA to Agricultural Products.” 1996. Centre of Environmental Science Leiden University (CML), Centre of Agriculture and Environment (CLM), Agricultural-economic Institute (LEI-DLO). CML report 130. Translated by Nigel Harle.

³⁶ *ibid.*

³⁷ Coley, D.A., E. Goodliffe, and J. Macdiarmid. 1998. The embodied energy of food: the role of diet. *Energy Policy* 26(6):455-459.

³⁸ Bickerstaffe, J. and B. Tucker. 1993. Industry Council for Packaging and the environment guide to the Boustead study on resource use and liquid food packaging 1986-1990. Industry Council on Packaging and the Environment. London, 22 p.

³⁹ Annika Carlsson-Kanyama. 2000. “Energy Use in the Food Sector: A data survey.” Dept. of Systems Ecology, Stockholm University, Sweden. AFR-report 291.

⁴⁰ Kooijman, J.M. 1993. “Environmental assessment of packaging: Sense and sensibility.” *Environmental Management* 17(5):575-586.

⁴¹ Carlsson, A. 1997. “Greenhouse gas emissions in the life-cycle of carrots and tomatoes.” IMES/EESS Report No. 24, Department of Environment and Energy Systems Studies, Lund University, Sweden.

⁴² Heller, Martin. C., and Gregory A. Keoleian. 2000. *Life Cycle-based Sustainability Indicators for Assessment of the U.S. Food System*. University of Michigan, Center for Sustainable Systems. Report No. CSS00-04.

sustainable. The study concluded that the most effective way to develop a more sustainable food system is to change attitudes and behaviors about food consumption.

Energy costs for marketing and transportation of food products

The 1999 energy bill for marketing food in the United States totaled \$21.6 billion, accounting for 3.5 percent of retail food expenditures.⁴³ It is estimated that 6 to 12 percent of the consumer dollar spent on food consumed in the home represents transportation costs.⁴⁴ From 1985 through 1991, the average transportation charge for Florida tomatoes shipped to the upper Midwest was 6.3 percent of the retail cost.⁴⁵ Oil prices affect the trucking industry, which uses diesel fuel. Declining diesel oil prices through the 1990s tended to restrain food transportation cost increases.⁴⁶

Food miles – the distance food travels from farm to consumer

A food mile is the distance food travels from where it is grown or raised to where it is ultimately purchased by the consumer or other end-user. One 1969 estimate of miles traveled by food in the United States cited an average distance of 1,346 miles.⁴⁷ Calculations made by John Hendrickson using a 1980 study examining transportation and fuel requirements estimated that fresh produce in the United States traveled an estimated 1,500 miles.⁴⁸ Fresh produce arriving in Austin, Texas, was estimated to travel an average of 1,129 miles.⁴⁹ An analysis of the USDA Agricultural Marketing Service's 1997 arrival data from the Jessup, Maryland, terminal market found that the average pound of produce distributed at the facility traveled more than 1,685 miles.⁵⁰ This same study showed the average distance for fruits to be transported was 2,146 miles, while the average for vegetables was 1,596 miles.⁵¹

In developed, industrial nations, food appears to be traveling farther to reach the consumer. Agricultural imports into the United States increased 26 percent by weight from 1995 to 1999.⁵² One metric ton of food transported by road in the United Kingdom traveled an average distance of 77 miles in 1998 compared with 51 miles in 1978.⁵³ A Swedish study of food miles used the ingredients from a Swedish breakfast (apple, bread, butter, cheese, coffee, cream, orange juice, and sugar) to sum the distances that each food traveled from the producers to consumer. The mileage estimated for the meal

⁴³ "Food Review" 2000. 23(3):28. USDA Economic Research Service.

⁴⁴ Rhodes, V. James. 1993. *The Agricultural Marketing System*, 4th Edition. Scottsdale, Arizona: Gorsuch, Scarisbrick, Publishers.

⁴⁵ Fresh Vegetable Prices and Spreads. USDA-ERS. Web site March 2001. (<http://www.ers.usda.gov/data/sdp/view.asp?f=specialty/88009/>)

⁴⁶ "Food Review" 2000. 23(3):30. USDA Economic Research Service.

⁴⁷ U.S. Department of Defense. 1969. *U.S. Agriculture: Potential Vulnerabilities*. Stanford Research Institute, Menlo Park, CA.

⁴⁸ Hendrickson, John. 1996. "Energy use in the U.S. Food System: A Summary of existing research and analysis." Sustainable Farming-REAP-Canada. Ste. Anne-de'Bellevue, Quebec. Vol 7, No 4. Fall 1997.

⁴⁹ *ibid.*

⁵⁰ Hora, Matthew, and Jody Tick. 2001. "From Farm to Table: Making the Connection in the Mid-Atlantic Food System." Capital Area Food Bank of Washington D.C. report.

⁵¹ *ibid.*

⁵² "Foreign Agricultural Trade of the United States" (FATUS). 2000. Economic Research Service, USDA.

⁵³ DETR. 1999. "Transport of Goods by Road, 1998" HMSO, London.

was equivalent to the circumference of the earth.⁵⁴

Calculating food miles for table grapes using a weighted average source distance (WASD)

Prior to the late 1960s, most Americans ate table grapes when the local and California markets could supply them – roughly from June through December. Since then, Americans have nearly tripled their table grape consumption from 2.52 pounds per person (per capita utilization) in the 1972/73-market year to 8.21 pounds per person during the 1999/2000-market year.⁵⁵ A major reason for this increase in consumption is the increase in the amount of imported grapes from Chile and other Southern Hemisphere countries during winter and early spring when California grapes are not available. The amount of imported grapes during this period (as a percentage of total consumed) rose from 4 to 45 percent, while exports of California grapes remained fairly steady.⁵⁶ The significant increase in imported grapes implies an increase in the average distance that table grapes travel to reach the U.S. consumer.

Methods

One way to estimate food miles is to use a weighted average source distance (WASD).⁵⁷ The WASD from production source to consumption endpoint is a single distance figure that combines information on distances from producers to consumers and the amount of food product transported. To provide perspective on the increase in food miles traveled, we have calculated the WASD for table grapes consumed in Iowa in three different years.

The formula for the WASD is:

$$\text{WASD} = \frac{\sum (m(k) \times d(k))}{\sum m(k)}$$

where:

k = different locations of the production origin,

m = amount consumed from each location of consumption origin, and

d = distances from the locations of production origin to the point of consumption.

⁵⁴ Gunther, F. 1993. "Phosphorus flux and societal structure." *A Holistic Approach to Water Quality Management: Finding Life-styles and Measures for Minimizing Harmful Fluxes from Land to Water*, Stockholm Water Symposium 10-14 August 1992, Stockholm, Sweden, Pub. No. 2. Stockholm Water Co., pp. 267-298.

⁵⁵ Specialty Crops Branch, ERS-USDA. 2000.

⁵⁶ Market and Trade Economics Division, ERS-USDA. 2000. (Reporting years represent a May to April cycle. Population figure is from January of the latter year in each case.)

⁵⁷ Carlsson-Kanyama, Annika. 1997. "Weighted average source points and distances for consumption origin-tools for environmental impact analysis." *Ecological Economics* 23(1997) 15-23.

For these calculations, we made a number of assumptions:

- Iowa's average per capita table grape consumption is equivalent to the U.S. average, and the consumption reference point is Des Moines.
- Distances are estimated by using latitude/longitude coordinates from an Internet site (<http://indo.com/distance/>) to determine a direct distance that is "as the crow flies" between the two points rather than actual transport route. We chose to go with this distance estimation because transportation routes vary for table grapes imported into Iowa from Chile and South Africa.
- We have used a 1 percent floor for these calculations; only states or countries providing 1 percent or more of the total poundage of table grapes were included.
- In 1972/73 accurate import data for that year were not readily available on which countries provided fresh grapes to the United States, but it is very likely that the majority of imported grapes came from Chile. Almost all of the remaining 96 percent of the table grapes was grown in California.

Results

WASD calculations for three production years for table grapes can be found in Table 3. The 1972/73 WASD was calculated at 1,590 miles. In 1988/89, the WASD had increased to 2,848 miles, an 89 percent gain over the 1972/73 figure. Most of this increase in distance can be explained by the significant increase in exports of Chilean table grapes to the United States and the corresponding increase in annual consumption. In 1998/99, the WASD was relatively unchanged at 2,839 miles, primarily because of the increase in Mexican table grape imports relative to the total amount of table grapes consumed. (Mexican table grapes had a slightly shorter transport distance from production [Mexico] to consumption point [Des Moines] than the California-grown grapes.)

Other uses for the WASD

The WASD for table grapes has been calculated in other countries. In Sweden, a WASD for table grapes was calculated using a consumption point in Stockholm, Sweden. The WASD increased by almost 100 percent from 1965 to 1992.⁵⁸ This change reflects an increase in imports of table grapes grown in Chile, Australia, and the United States.

The WASD can be estimated from production and shipping records for various fresh fruits, vegetables, meats, and other foods. It is much more complicated to calculate the WASD for multi-ingredient processed products.

Using the WASD to calculate food miles for produce arriving at the Chicago, Illinois terminal market

One late 1970s estimate indicated that in the United States approximately 60 percent of food and related products were transported from the farm by truck and the remaining 40 percent by rail.⁵⁹ In the past 25 years, with an improved road infrastructure in the

⁵⁸ Carlsson-Kanyama, Annika. 1997. "Weighted average source points and distances for consumption origin-tools for environmental impact analysis." *Ecological Economics* 23(1997) 15-23.

⁵⁹ Pimentel, David, and Marcia Pimentel. 1979. *Food, Energy, and Society*. New York: John Wiley and Sons.

United States and other developed nations, the amount of food transported by truck has increased dramatically. According to a 1996 USDA study, nearly 93 percent of fresh produce transported between cities in the United States was moved by truck.⁶⁰

The USDA's Agricultural Marketing Service (AMS) tracks shipments and exports of fresh fruits and vegetables by commodities, modes of transportation, origins, and months in the calendar year. The AMS also tracked produce arrivals at various terminal markets throughout the United States until budget limitations forced the elimination of this data collection in 1998.⁶¹ Terminal markets for produce have declined in importance in the United States; currently there are only 22 major terminal markets that handle an estimated 30 percent of the volume of the nation's produce.⁶² The decline in terminal market share is a reflection of the increased purchasing power of integrated wholesale-retail buying entities.⁶³

Although terminal market share has declined, the arrival data collected through 1998 provide a realistic picture of where produce comes from during the calendar year. To provide an upper Midwest perspective on how far food travels, we examined the arrival data at the Chicago, Illinois terminal market collected by the AMS for the years 1981, 1989, and 1998. Chicago was chosen over other terminal markets because of its proximity to Iowa and the assumption that it approximated the purchasing source percentages of integrated wholesale-retail produce buyers in Iowa.

Methods

The Chicago terminal market arrival data document the total amount of produce that arrived at the market from states, countries, and territories. We used the data to calculate two WASDs; one for produce arriving from locations in the continental United States by truck, and one for total arrivals by truck that originated from outside of the continental United States. We calculated arrivals by truck and rail as a percentage of total arrivals for produce grown within and outside the continental United States. We also calculated arrivals by truck from California and Florida as a percentage of total arrivals. The following assumptions were made in the calculations:

- For the truck WASD calculations, distances from the production origin within the continental United States and Canada to the terminal market were estimated by using a city located in the center of each state as the production origin. (In Canada we took the average distance from the center of two major produce areas to Chicago.) Then we calculated a one-way road distance to Chicago using the Internet site Mapquest (mapquest.com).

⁶⁰ U.S. Department of Agriculture Agricultural Marketing Service. 1996.

⁶¹ Douglas Edwards, USDA Agricultural Marketing Service, February 2001. Personal communication.

⁶² Cook, Roberta. 2001. "The Dynamic U.S. Fresh Produce Industry: An Industry in Transition." *Postharvest Technology of Horticultural Crops*, Third Edition. Adel A. Kader. University of California Division of Agriculture and Natural Resources. (In press.)

⁶³ *ibid.*

- Distances from Puerto Rico, Hawaii, and other countries to Chicago were calculated using the Internet site (<http://.indo.com/distance/>) which uses latitude and longitude to determine a direct distance that is “as the crow flies” between the two points rather than actual transport route. This was done because it is difficult to find the data to determine the shipping routes taken to each customs port in the United States, and transportation routes from the port to Chicago.

Results

Table 4 shows the WASD for produce arriving by truck at the Chicago terminal market from within the continental United States and by truck from outside of the continental United States for 1981, 1989, and 1998. The table also shows the percentage of produce arrivals each year that is carried by rail and truck from the continental United States, by truck from California and Florida, and from other countries, states, and territories outside of the continental United States.

In 1981, produce traveled an average of 1,245 miles by truck from locations within the continental United States to reach the Chicago terminal market. The average distance for produce arriving by truck in the continental United States increased to 1,424 miles in 1989, and to 1,518 miles in 1998. The 1998 estimate is a 22 percent increase in distance over the 1981 figure.

In 1981 about 50 percent of produce from all locations arrived by truck and 50 percent by rail. (When considering only the continental United States, 46 percent arrived by truck and 54 percent by rail.) In 1998 nearly 87 percent of the produce arriving at the Chicago terminal market from all locations came by truck. (Almost 84 percent arrived by truck when considering locations within the continental United States.) The rise in average distance traveled by truck is likely due, in part, to the increase in total amount of produce arriving by truck, and subsequent decrease in arrivals by rail. Rail accounted for only 13 percent of the total produce arriving at the Chicago market in 1998 (16 percent when considering produce originating within the continental United States).

California and Florida supplied a combined 38.4 percent of produce from all sources in 1981 and 45.7 percent in 1998. No other state, with the exception of Wisconsin in 1981, supplied more than 6 percent of the produce per year from all sources for the three years analyzed.

In 1981 about 12.5 percent of the produce arriving by truck at the Chicago terminal market from all locations was grown outside of the continental United States. That percentage rose to 16.4 percent in 1989, and increased to 21.5 percent in 1998. The WASD for arrivals by truck of produce originating from outside of the continental United States was 2,160 miles in 1981, increased to 2,633 miles in 1989, but decreased to 2,242 miles in 1998. The decrease in 1998 was likely due to a significant increase in produce arriving from Mexico (13.5 percent of total in 1998 compared with 4.5 percent in 1989 and 3.6 percent in 1981).

Comparison of food miles – Iowa local food system examples

Table 5 compares the distances traveled for locally and regionally grown foods used in three meals compared with the distances traveled if those foods came from conventional sources outside of the state. The average total distance for the three locally sourced meals was 1,198 miles. The average total distance for the meals using the same meal ingredients obtained from conventional sources was 12,558 miles, more than 10 times the distance. WASDs were not used in this example.

A number of local food system projects, including several supported by the Leopold Center, have been initiated in Iowa over the past several years. These projects have reported success in increasing sales of locally grown and processed produce, meats, and beverages to hotels, restaurants, and institutions such as hospitals, universities, schools, restaurants, workplace cafeterias, and conference centers. To contrast the distance food travels in a locally-based versus a conventional system, we compared WASDs for several Iowa institutional projects with WASDs for a conventional system sourcing the same products within the continental United States.

Methods

A sample of food distribution data from three Leopold Center-funded local food projects in Black Hawk, Johnson, and Story counties was used. Data were available on total pounds of product delivered, delivery location, and address of the grower. Food items included meat and produce. One-way distance from the farm to institution was estimated using the Internet site Mapquest (mapquest.com). Using this information, we estimated a WASD for each project, and a combined WASD across all three projects. We then calculated a WASD for each project site and a combined WASD across all project sites for the same food items, assuming they were produced in a state that currently supplies Iowa with a significant amount of that food.

Results

Table 6 shows the WASD comparisons. The local food traveled an average distance of 44.6 miles across all food projects, while that same food would likely travel an average of 1,546 miles if it came from conventional sources. When considering produce only, the local food traveled an average distance of 37.9 miles, while the produce would likely travel an average of 1,638 miles if it came from conventional sources.

Food miles, fossil fuel use, and greenhouse gas emissions

As mentioned in Table 2 and in the section “Energy use in the food system” the food system was estimated to account for 16 percent of total U.S. energy consumption. Agricultural activities were responsible for 7.7 percent of total U.S. greenhouse gas emissions in 1997.⁶⁴ Energy use and gaseous emissions from the transport of food vary by mode of transportation. Table 7 shows the estimated values for energy consumption and for carbon dioxide and other gaseous emissions for four transportation modes.

⁶⁴ Environmental Protection Agency. 1999. “Inventory of Greenhouse Gas Emissions and Sinks: 1990-1997.” EPA 236-R-99-003. U.S. Environmental Protection Agency, Washington, D.C. Web site April 2001 (<http://www.epa.gov/globalwarming/publications/emissions/us1999/index.html>).

Clearly, air transportation is the least energy efficient method and produces more emissions in transporting food or other goods, followed by road (truck), rail, and water.

Reductions in transport-related carbon dioxide emissions when food items are sourced locally rather than conventionally have been documented in several research studies. A recent British study showed that purchase of local apples resulted in an almost 3,000 percent reduction in energy use and 87 percent lower carbon dioxide emissions than apples imported from New Zealand.⁶⁵ The mode of transportation, however, must be taken into account before assuming that energy use and CO₂ emissions will be lower for food that is transported for shorter rather than longer distances. Table 7 shows that a given amount of food transported by water could travel seven times farther than the same amount of food transported by road (truck) and still not use more energy or release more greenhouse gases.

Comparing fuel use and CO₂ emissions for three food distribution systems

What type of transportation fuel savings would be realized if Iowa grew more of its own food? How much of a reduction in CO₂ emissions would result from the fuel savings? To help answer these questions, we have estimated fuel use and CO₂ emissions for transporting from the farm (production origin) to the point of sale 10 percent of 28 different fresh produce items that Iowans consume annually, using three different food systems.

Methods

For the purposes of this comparison, we define these three food systems as follows:

Conventional system: This is an integrated retail/wholesale buying system in which national sources supply Iowa with a significant percentage of its produce through retail supermarkets, restaurants, and other institutional markets served by brokers and distributors. Iowa now receives a good deal of produce from other countries, but to simplify calculations we chose to focus on national sources. This system uses large semi-trailer trucks for transport.

Iowa-based regional system: Although there are a few Iowa farms that supply significant volumes of produce to retail supermarkets and institutions, most Iowa horticultural producers are not part of a coordinated, farmer-owned, cooperative infrastructure to grow and market fruits and vegetables. An existing network of brokers and distributors uses a regional infrastructure to deliver produce to Iowa supermarkets, restaurants and institutions, but they do not currently use a significant amount of Iowa-grown produce. We will hypothesize an Iowa-based regional system modeled after this existing system that could supply retail, wholesale, and institutional markets through some type of cooperative network of small and midsize farms. This hypothetical system would use large semitrailer trucks and midsize trucks for transport.

⁶⁵ Jones, J.A. 1999. "The environmental impacts of distributing consumer goods: a case study on desert apples." Ph.D. Thesis. Centre for Environmental Strategy, University of Surrey, Guildford, Surrey, UK.

Local system: This represents farmers who market and sell directly to consumers or food buyers. To simplify our calculations we divided this group into two markets – selling through CSAs and farmers markets, and selling to restaurants/institutions. This system uses many different types of light-duty trucks, cars, and vans for transport. We selected light-duty gasoline trucks as the vehicle type to transport produce in this system.

Our intent was to determine whether there would be transportation fuel savings and CO₂ emission reductions if 10 percent more of the fresh produce consumed by Iowans was grown in local or regional systems. For these calculations, we made a number of assumptions.

To estimate food consumption:

- National per capita consumption data⁶⁶ (three-year average for 1997-99) were used to estimate Iowa consumption totals for all 28 selected produce items.

To select production sources for the conventional system:

- We selected a state that we were confident grew at least 10 percent of the total of Iowa's annual consumption for each of the 28 produce items. These states have a track record of supplying a significant amount of the demand to the upper Midwest during Iowa's growing season. Arrival data for 1998 from Chicago's terminal market were used as a reference. The produce/state pairings made to estimate distances can be found in Table 8.

To estimate one-way mileage in the three systems:

- For the conventional system one-way mileage from the center of the state to Des Moines, Iowa, were used to estimate the distance from farm to point of sale. Des Moines was chosen as the destination point because it is close to the center of Iowa, is at the intersection of the state's two major interstate highways, and is a major distribution point for produce. Distances were estimated by using the Internet site MapQuest (mapquest.com).
- For the Iowa-based regional system a distance of 82 miles was estimated as a one-way average travel distance from farm to point of sale. This number represented the average distance from 15 locations uniformly spread across Iowa to the two closest major Iowa market or distribution areas (Des Moines, Chariton, Cedar Rapids, Boone, Sioux City, Davenport, and Omaha, Nebraska). Choosing the two closest major market areas for each of the 15 locations provided 30 data points (15x2) for the estimation. Distances were estimated by using the Internet site MapQuest (mapquest.com).
- For the local food transport system serving institutional markets an average one-way distance of 38 miles would be used. This estimate can be found in Table 5, where we calculated the average one-way distance that local produce traveled across three institutional local food system projects.

⁶⁶ "Food Consumption, Prices and Expenditures, 1970-1999." Economic Research Service. USDA. Statistical Bulletin No. 965.

- For the local food transport system servicing CSA and farmers markets an average one-way distance of 21.2 miles from farm to point of sale would be used. This figure represents the average one-way distance from the farm to Ames for all Ames downtown farmers' market vendors and regular producers serving the Magic Beanstalk CSA. Produce distribution data (by weight) was not readily available for this local system, so a WASD could not be calculated.
- Backhauls were not included in any of the calculations because the trucks often do not return directly to their original destinations. For example, produce trucks from California traveling to the upper Midwest may unload produce in Iowa, pick up another load of goods in Iowa or another state, and then return to California.

To select transport vehicles, load capacities, and fuel economies for the three systems:

- Calculations were made for produce in the conventional and Iowa-based regional systems using heavy-duty semitrailer truck rigs that carry 40,000 pounds.^{67 68} Five percent of the load would be container weight, for a total produce weight per truck of 38,000 pounds. These heavy-duty trucks would use a gallon of diesel fuel for every 6.1 miles they travel.⁶⁹
- Calculations in the Iowa-based regional system were made also for a midsize truck capable of hauling 14,500 pounds of produce, of which 5 percent would be container weight.⁷⁰ These midsize diesel trucks would use a gallon of diesel fuel for every 8.5 miles they travel.⁷¹ Both semitrailer and midsize trucks are currently used to transport produce for wholesale and retail markets in Iowa.
- For the local food system we selected a light gasoline-fueled truck that could transport a maximum load of 1,635 pounds,⁷² 5 percent of which is container weight. For our estimations the light trucks will use a gallon of regular gasoline for every 17.2 miles they travel.⁷³

Other assumptions:

- Fuel use calculations and CO₂ emissions are based on transporting produce from farm to point of sale. Fuel used and emissions generated in production, in transport to an on-farm cooling facility, in transport for indirect routes needed for processing or storage, or by consumers to transport the produce from point of sale to home are not considered. Indirect fuel use and CO₂ emissions resulting from manufacturing

⁶⁷ Dwight Minami, Center for Agricultural Business, California State University–Fresno. February 2001. Personal communication.

⁶⁸ Hagen, J.W., D. Minami, B. Mason, and W. Dunton. 1999. "California's Produce Trucking Industry: Characteristics and Important Issues." Center for Agricultural Business, California Agricultural Technology Institute, California State University–Fresno.

⁶⁹ Bureau of Transportation Statistics, National Transportation Statistics. 1999. "Combination Truck Fuel Consumption and Travel" Table 4-14 Web site March 2001(www.bts.gov/ntda/nts/NTS99/data/Chapter4/4-14.html).

⁷⁰ Transport load and fuel efficiency represent an average for midsize trucks taken from two Iowa-based produce brokering and distribution companies.

⁷¹ *ibid.*

⁷² Average standard payload of six different light pick-up trucks from Chevrolet, Ford, and Dodge, 2000 models.

⁷³ Bureau of Transportation Statistics. National Transportation Statistics. Table 4-12 Other 2-Axle 4-Tire Vehicle Fuel Consumption (light trucks) 1999. Web site March 2001 (www.bts.gov/ntda/nts/NTS99/data/Chapter4/4-12.html).

- the trucks or building the roads are not considered.
- Each of the three food systems could supply 10 percent of the estimated per capita consumption of the 28 selected produce items.

Results

Table 9 compares the fuel used, CO₂ released, and total distance traveled (from farm to point of sale) if 10 percent of the produce consumed in Iowa were distributed by conventional, Iowa-based regional, and local systems. The conventional food system's semitrailers had nearly 17 times higher fuel use and CO₂ emissions compared with the semitrailers in the Iowa-based regional system, and 8.5 times higher fuel use and CO₂ emissions than the midsize trucks in the Iowa-based regional system. The conventional food system's semitrailers traveled nearly 17 times farther than the semitrailers in the Iowa-based regional system, and six times farther than the midsize trucks in the regional system.

The conventional food system's semitrailers used more than four times the fuel when compared with the local food system's light trucks used for institutional markets, and emitted almost five times the CO₂, but only traveled 1.5 times as far as the light trucks. The light trucks had to make more trips to deliver 10 percent of the per capita consumption target. The conventional food system's semitrailers used nearly 7.5 times the fuel, emitted more than 8.5 times the CO₂, and traveled nearly three times as far as the local food system's light trucks used for CSA and farmers markets.

Growing and transporting 10 percent more of the produce for Iowa consumption in an Iowa-based regional or local food system would result in savings ranging from 280 to 346 thousand gallons of fuel, depending on the system and truck type. The high end of this fuel saving (found in the regional system) would be equivalent to the average annual diesel fuel use of 108 Iowa farms.⁷⁴ The fuel cost savings (based on June 2001 fuel prices), depending on system and truck type, would range from \$440,377 to \$546,393.

Growing 10 percent more of the produce for Iowa consumption in an Iowa-based regional or local transport system would result in a reduction in CO₂ emissions of 6.7 to 7.9 million pounds, depending on the system and truck type.

Discussion

The calculated reductions in fossil fuels and CO₂ emissions are based on 10 percent of the estimated Iowa consumption of 28 fresh fruits and vegetables grown in the state. These reductions are quite small when considering potential savings of the recommended options to increase fuel efficiency and reduce greenhouse gas emissions made

⁷⁴ Duffy, Michael. 1989. "Energy Use on Iowa Farms: A survey of energy use and cropping operations." Special Report SR-91-01. Leopold Center for Sustainable Agriculture. Ames Iowa.

in Iowa's 1996 Greenhouse Gas Action Plan.⁷⁵ Ten percent of these 28 produce items, however, represents less than 1 percent of total food and beverage per capita consumption by weight (not including water) in Iowa.⁷⁶ If a higher percentage of meats, processed foods, and beverages were grown and/or processed in Iowa, the reductions in fuel usage and resulting CO₂ emissions from transport would be significantly higher.

Our intent was to estimate some of the hidden environmental costs connected to the current conventional food system's reliance on semitrailers traveling great distances to bring food to Iowa. Using limited data and a set of assumptions, this study has estimated the transportation fuel usage and CO₂ emissions for three food systems. A more comprehensive study might be undertaken to include backhauls and account for produce arriving from other countries as well as the United States. One could document specific vehicle load weights for each type of produce (for example, a load of peppers will weigh less than a load of cucumbers), and track fuel efficiencies for specific truck types across different food distribution systems. A significant obstacle in undertaking such a comprehensive study is the lack of available data from public sources.

Application of results: using food miles to estimate fuel use and CO₂ emission reductions without local data

We have shown examples where food transported in local and Iowa-based regional systems travels fewer miles, uses less fuel, and emits less CO₂ than a conventional system. Are there simpler ways of estimating fuel consumption and CO₂ reductions used in food transport that might come from an increased reliance on local and regional food systems, particularly when local data are not available? One alternate approach is to develop a food system scenario where increased reliance on local and regional food systems leads to a reduction in the average distance food is transported (from production to point of sale).

We turn back to the produce arrival data from the Chicago terminal market to develop an example. Our analysis of produce arrival data at the Chicago terminal market showed that the upper Midwest relies on both national and international sources to supply most of its produce. If the upper Midwest relied more upon a multi-state regional system to provide its produce, the average distance that produce would travel from farm to point of sale would decrease.

Methods

Our intent was to estimate how much fuel would be saved and CO₂ not released if a multi-state regional food system could reduce the average produce transport distance by a certain target mileage. To estimate the possible reductions in fuel usage and CO₂

⁷⁵ Ney, R.A., J.L. Schnoor, N.S.J. Foster, and D.J. Korkenbrock. 1996. "Iowa Greenhouse Gas Action Plan." Report prepared for the Iowa Department of Natural Resources by the Center for Global and Regional Environmental Research Public Policy Center, University of Iowa.

⁷⁶ Estimate based on USDA-ERS 1996 per capita consumption data by major food categories for the United States. Beverage consumption in gallons was converted into pounds, and it was assumed that the 28 fruits and vegetables used in this study represented 75 percent of all fresh fruits and vegetables consumed. It was also assumed that the national per capita consumption data could be used to estimate Iowa consumption.

emissions, we hypothesized a multi-state regional system and compared it to the conventional system. To make the calculations, we made several assumptions.

To define our target area:

- We defined the upper Midwest as a six-state region including Iowa, Minnesota, Wisconsin, Indiana, Illinois, and Michigan, with Chicago as market hub.

To estimate food consumption:

- National per capita consumption data⁷⁷ (three-year average for 1997-99) was used to calculate per capita consumption for each of these six states for the same 28 fruits and vegetables identified in Table 8.
- Arrival data from the 1998 Chicago terminal market indicated that 84 percent of the produce arriving from within the continental United States came by truck, and the remaining 16 percent came by rail. We reduced total consumption by 16 percent so produce traveling by rail would not be included in our estimations.

To select transport vehicle type, load capacity, and fuel economy for the hypothesized system:

- The system would use a semitrailer truck that can transport 40,000 pounds (five percent of the load would be container weight, for a total produce weight per truck of 38,000 pounds) and get 6.1 miles per gallon of diesel fuel.^{78 79}
- Backhauls were not considered.

To estimate a target reduction distance:

- We subtracted the 1981 WASD from the 1998 WASD for arrival by trucks in the continental United States (shown in Table 4) and found a difference of 273 miles. We used that difference as our target reduction distance.

Results

If a regional production and distribution system used for fresh produce for this six-state region reduced by 273 miles the average one-way distance that produce traveled by truck, this reduction would translate into savings of 8.8 million gallons of diesel fuel per year. The amount of CO₂ emissions would decrease by 194.8 million pounds.

Conclusions

The infrastructure and decision-making in the current food system are based on profitability, and often do not take into account external environmental or community costs. This paper has documented several cases and scenarios where food produced within

⁷⁷“Food Consumption, Prices and Expenditures, 1970-1999.” Economic Research Service. USDA.

⁷⁸ Hagen, J.W., D. Minami, B. Mason, and W. Dunton. 1999. “California’s Produce Trucking Industry: Characteristics and Important Issues”. Center for Agricultural Business, California Agricultural Technology Institute, California State University – Fresno.

⁷⁹ Bureau of Transportation Statistics, National Transportation Statistics. “Combination Truck Fuel Consumption and Travel” 1999. Table 4-14. Web site March 2001 (<http://www.bts.gov/ntda/nts/NTS99/data/Chapter4/4-14.html>).

local or regional food systems travels fewer miles (from farm to point of sale) than the food produced within a conventional system. The shorter transportation distances for these local and state-based regional food systems led to reduced transportation fuel use and CO₂ emissions compared to the conventional system. We hope that this study will encourage others involved in local food system efforts to compare their transportation fuel use and resulting CO₂ emissions with the conventional system.

The energy crisis in California has resulted in higher prices for cooling and storing California-grown produce and other foods, resulting in higher selected food prices for distributors, retailers, and consumers.⁸⁰ High fuel costs have led to protests by independent truckers, who claim the increases threaten their livelihoods.⁸¹ Rising fuel and electricity costs may make food distributors, brokers, and retailers more receptive to using local and regional food systems.

Given that fuel expenses are only a small percentage of total transportation and distribution costs, however, fuel costs will need to rise significantly if they are the only factor considered in determining whether local and regional systems are economically competitive with the conventional system. According to research conducted at Iowa State University in 1985, rising fuel costs did not provide a competitive advantage to producing 13 different horticultural crops in Iowa rather than shipping them in from other states.⁸² This research, however, did not assign economic value to the environmental benefit of reducing fossil fuel use and greenhouse gas emissions. It also did not take into account the community benefit to increasing markets for Iowa producers. Based on our consumption estimates for the 28 fruits and vegetables discussed earlier in this paper, if an additional 10 percent of these produce items were grown and sold in Iowa, it would result in \$54.3 million dollars in sales for Iowa farmers (based on wholesale prices). These dollars would multiply several times in Iowa communities rather than communities in other states or countries.

Application of findings to consumers

"Cause marketing" is marketing that connects a business' product to a particular cause or set of values, in the hope that those consumers with similar values will be more likely to purchase the product.⁸³ A 1997 marketing report indicated that price and quality being equal, 76 percent of consumers would switch to a brand of product they considered to be supporting a good cause.⁸⁴ Some consumers may buy a food product because it is locally grown, while others may be interested in whether it is organic, protects soil and water resources, or provides good wages and working conditions for the farm workers. Others may be looking for several of these attributes. Collaborative cause

⁸⁰ "California Power Crisis Sends Shock Waves Nationwide," January 2001. CNN. Web site March 2001 (<http://www.cnn.com/SPECIALS/2001/power.crisis/background.html>)

⁸¹ "Truckers converge on Washington to seek fuel price relief," March 2000. CNN. Web site March 2001 (<http://cnn.ch/2000/US/03/16/gas.prices.01/>).

⁸² Weimar, Mark R. 1985. "The economic production potential for fresh summer fruits and vegetables in Iowa's commercial wholesale market with emphasis on small farms." Ph.D Thesis, Iowa State University.

⁸³ *Collaborative Cause Marketing Handbook for the Specialty Food Industry*. January 2000. Appalachian Center for Economic Networks.

⁸⁴ Cone, Carol L. and Mark A. Feldman. 1997. *Cause-Related Marketing Trends Report*. Boston, MA. Cone Communications.

marketing,⁸⁵ which correlates different value sets with food product attributes, may answer their needs.

We believe there is a segment of the population who support environmental causes and are concerned about CO₂ emissions and fossil fuel use. It is uncertain whether these consumers see a move to a more local or regional food system as relevant to their own cause. This paper helps to make the connection between food choices, fossil fuel use, and greenhouse gas emissions. The information may be useful for producers, processors, and retailers wanting to build relationships with consumers concerned about these environmental issues.

Locally grown food as the “load less traveled”: importance of considering the entire food system

Although food transported in local and regional food systems may travel fewer miles and use less fossil fuel to reach the consumer, one cannot assume that these systems are more energy efficient compared to the conventional food system. The importance of Life Cycle Assessment (LCA) cannot be overlooked when considering transport-related fuel use and carbon dioxide emissions within the context of the entire food system. Carbon dioxide equivalents per kilogram of tomato were compared over a 20-year period for tomatoes grown in Denmark, the Netherlands, Sweden (with Sweden being the end consumption point), and other countries.⁸⁶ Spanish tomatoes were shown to have lower CO₂ equivalents than those produced in Denmark, the Netherlands, and Sweden, even though the transportation distances to Sweden were shorter than for the Spanish tomatoes. The reason is that the Spanish tomatoes were raised in open ground while the Swedish, Dutch, and Danish tomatoes were raised in heated greenhouses, which required more fossil fuel energy in crop production. Transportation energy savings for the systems with shorter transport distances were overshadowed by higher energy needs in crop production. The results of this Swedish study underscore the importance of examining fuel use and CO₂ emissions across all sectors of the food system.

Recommendations for action

These actions are suggested to better document the external costs of the current food system, reduce fuel use and CO₂ emissions from food transport, and to examine potential benefits of more local and regional food systems:

For Iowa consumers:

- Buy local or regionally grown food whenever possible. Several resources produced by the Iowa Department of Agriculture and Land Stewardship, Practical Farmers of Iowa, and ISU Extension give Iowans information on how and where to sell or

⁸⁵ *Collaborative Cause Marketing Handbook for the Specialty Food Industry*. January 2000. Appalachian Center for Economic Networks.

⁸⁶ Carlsson-Kanyama, Annika. 1998. “Food Consumption Patterns and their Influence on Climate Change.” *Ambio* 27(7):528-34.

purchase food through farmers markets, community supported agriculture enterprises, direct sales, on-farm stores, and institutional markets.^{87 88}

- Grow your own fruits and vegetables, and look for opportunities to participate in community gardens.
- Plan effectively to minimize the number of shopping trips you make to purchase food. Whenever possible, coordinate your trip to the grocery store with your trip to the farmers market.
- Encourage grocery store managers and farmers market managers to work together so that farmers markets can be held in or close to the parking lots of grocery stores.
- Consult with nutritionists to encourage replacement of foods with low nutrient value with more nutrient dense fresh foods that can be easily grown in Iowa. For example, cabbage has more nutrients and can be stored for longer time periods than lettuce.

For Iowa farmers, retailers, and food brokers:

- Pursue opportunities to market produce and meats locally and regionally. These opportunities include direct marketing efforts and cooperative supply networks. Groups such as Practical Farmers of Iowa and the Iowa Network for Community Agriculture can provide information and contacts.
- Diversify production and processing to meet the growing demand for local food products.
- Research opportunities to add value to foods grown on Iowa farms.
- Work with researchers on season-extending technologies for fruits, vegetables, grains, and legumes, keeping in mind external environmental and community costs.
- Work to locate farmers markets near grocery stores and supermarkets. This would reduce consumer fuel usage and may increase business for both groups.

For food system researchers and educators:

- Conduct baseline research that compares conventional, regional, and local food systems regarding fossil fuel energy used in all sectors of the food system (production, processing, storage, transportation, distribution).
- Compare energy efficiencies and greenhouse gas emissions between truck and rail transport systems.
- Conduct baseline research to show whether increased use of local and regional food systems in the United States would decrease the ecological footprint.⁸⁹ (The ecological footprint measures human impact on nature.)
- Begin pioneering research in Iowa on the use of Life Cycle Assessments^{90 91} for specific fresh and processed food items.

⁸⁷ "2001 Farmers' Market Directory" 2001. "Iowa Family Farm Meats Directory" 2000. Iowa Department of Agriculture and Land Stewardship Web site June 2001 (<http://www.state.ia.us/agriculture>).

⁸⁸ Iowa CSA Farms. Iowa State University. ISU Extension Publication. PM 1693, Revised July 2000.

⁸⁹ Redefining Progress Web site April 2001 (http://www.rprogress.org/progsum/nip/ef/ef_projsum.html).

⁹⁰ "Application of LCA to Agricultural Products." 1996. Centre of Environmental Science Leiden University (CML), Centre of Agriculture and Environment (CLM), Agricultural-economic Institute (LEI-DLO). CML report 130. Translated by Nigel Harle.

⁹¹ Schenk, Rita C. 2001. *Life Cycle Assessment for Mere Mortals: A Primer on Environmental Life Cycle Assessment*. Institute for Environmental Research and Education, Vashon, WA.

- Develop or create simple stories that can be understood by consumers to explain the true price tag for each food item. Hidden external environmental and community costs need to be documented and presented to consumer groups. A set of educational materials entitled “Price Tags, Cost Tags,”⁹² developed by the University of Wisconsin’s Center for Integrated Agricultural Systems, could serve as a model.
- Develop economic models that assign value to the external environmental costs of our current food system and compare the same environmental costs with regional or local food systems.
- Continue on-farm research on extending Iowa’s fruit, vegetable, legume, and grain production season, keeping in mind external environmental and social costs.
- Conduct on-farm research on renewable alternative fuels for food production, processing, and transport within local and regional food systems.

For state and federal policymakers:

- Require that national and state and local food policy councils address energy efficiency of the food system in their work.
- Modify or eliminate state and federal rules that limit commerce of local and regional food systems.
- Formulate policy that provides incentives and regulations to develop new food labels that inform consumers on the relative level of external environmental and community costs.

⁹² “Price Tags, Cost Tags” 2000. Center for Integrated Agricultural Systems, University of Wisconsin. (Materials developed for poultry, tomatoes, coffee, and other food products.)

Table 1. Number of commodities produced for sale on at least 1 percent of all Iowa farms for selected years from 1920 to 1997

	1920	(%)	1935	(%)	1945	(%)	1954	(%)	1964	(%)	1978	(%)	1987	(%)	1997	(%)
Horses	(95)		Cattle	(94)		Cattle	(92)		Corn	(91)		Corn	(87)		Corn	(68)
Cattle	(95)		Horse	(93)		Chicken	(91)		Cattle	(89)		Soybeans	(68)		Soybeans	(62)
Chicken	(95)		Chicken	(93)		Corn	(91)		Hogs	(83)		Cattle	(60)		Hay	(42)
Corn	(94)		Corn	(90)		Horses	(84)		Hay	(82)		Hay	(56)		Cattle	(42)
Hogs	(89)		Hogs	(83)		Hogs	(81)		Soybeans	(79)		Hogs	(50)		Hogs	(19)
Apples	(84)		Hay	(82)		Hay	(80)		Oats	(72)		Oats	(34)		Oats	(12)
Hay	(82)		Potatoes	(64)		Oats	(74)		Chicken	(42)		Horses	(13)		Horses	(11)
Oats	(81)		Apples	(56)		Apples	(41)		Horses	(37)		Chicken	(09)		Sheep	(04)
Potatoes	(62)		Oats	(52)		Soybeans	(40)		Potatoes	(18)		Sheep	(08)		Chicken	(02)
Cherries	(57)		Cherries	(24)		Grapes	(23)		Sheep	(16)		Wheat	(06)		Ducks	(01)
Wheat	(36)		Grapes	(28)		Potatoes	(23)		Ducks	(05)		Goats	(01)		Goats	(01)
Plums	(29)		Plums	(28)		Cherries	(20)		Apples	(05)		Ducks	(01)		Wheat	(01)
Grapes	(28)		Sheep	(21)		Peaches	(16)		Cherries	(04)		Red clover	(02)			
Ducks	(18)		Peaches	(16)		Sheep	(16)		Peaches	(04)		Apples	(02)			
Geese	(18)		Pears	(16)		Plums	(15)		Goats	(04)		Ducks	(02)			
Strawberry	(17)		Mules	(13)		Pears	(13)		Grapes	(03)		Goats	(02)			
Pears	(17)		Ducks	(12)		Rd clover	(10)		Pears	(03)		Geese	(01)			
Mules	(14)		Wheat	(12)		Mules	(06)		Plums	(03)						
Sheep	(14)		Geese	(11)		Strawberry	(06)		Wheat	(03)						
Timothy	(10)		Sorghum	(09)		Ducks	(06)		Red clover	(03)						
Peaches	(09)		Barley	(09)		Wheat	(04)		Geese	(03)						
Bees	(09)		Red clover	(09)		Timothy	(04)		Popcorn	(02)						
Barley	(09)		Strawberry	(08)		Geese	(03)		Timothy	(02)						
Raspberry	(07)		Soybeans	(08)		Rye	(02)		Swt potato	(02)						
Turkeys	(07)		Raspberry	(06)		Popcorn	(02)		Swt corn	(01)						
Watermelon	(06)		Bees	(05)		Swt corn	(02)		Turkeys	(01)						
Syrup	(06)		Timothy	(05)		Raspberry	(02)									
Gooseberry	(03)		Turkeys	(04)		Bees	(02)									
Sweet corn	(02)		Rye	(02)		Sorghum	(01)									
Apricots	(02)		Popcorn	(02)												
Tomatoes	(02)		Sweet corn	(02)												
Cabbage	(01)		Swt clover	(01)												
Popcorn	(01)		Goats	(01)												
Currants	(01)															
n = 34			n = 33			n = 29			n = 26			n = 17			n = 12	
																n = 10

Prepared by Michael Carolan, Sociology Department, Iowa State University. Data is from U.S. Census of Agriculture.

Table 2. Energy use in the U.S. food system *

Sector	Average (percent)
Production	17.5
Processing	28.1
Transportation	11
Restaurants	15.8
Home preparation	25
Food system**	15.6

* (Excerpted from Table 2, "Energy Use in the Food System: A Summary of Existing Research and Analysis." Center for Integrated Agricultural Systems, University of Wisconsin-Madison.)

** percentage of total U.S. energy consumption used in the food system

Table 3. Weighted Average Source Distance (WASD) for table grapes with Des Moines, Iowa as consumption point

Year	WASD (miles)
1972/73	1,590
1988/89	2,848
1998/99	2,839

Table 4. Truck WASD estimations, and truck, rail, and foreign* arrivals as percent of total arrivals

Year	1981	1989	1998
Truck WASD – continental United States	1,245 miles	1,424 miles	1,518 miles
Truck WASD – foreign arrivals*	2,160 miles	2,633 miles	2,242 miles
Arrivals by truck overall – Percent of total	49.6%	68.6%	86.9%
Arrivals by rail overall – Percent of total	50.4%	31.4%	13.1%
Arrivals by truck – Percent of total - continental U.S. only	46.4%	64.7%	84.0%
Arrivals by rail – Percent of total continental U.S. only	53.6%	35.3%	16.0%
Arrivals by truck – California			
Percent of total	25.4%	31.2%	33.3%
Arrivals by truck – Florida			
Percent of total	13.1%	12.5%	12.4%
Foreign arrivals* – Percent of total	12.5%	16.4%	21.5%

* Includes all arriving produce that is not from the continental United States (including Puerto Rico and Hawaii) except a category entitled “imports,” which according to USDA-AMS is likely bananas. We did not use this category because it is difficult to know from which country the produce originated.

Table 5. Distances traveled for three locally grown meals compared to distance if same food items were supplied through conventional channels

Dinner - October 17, 1998

Food Item	Source	Distance Traveled	Distance as if through conventional channels (miles)
Chuck roast	Dan Specht (Clayton County)	75 miles	675 (CO)
Potatoes	farmers market	10-15 miles	1,300 (ID)
Carrots	our garden	40 feet	1,700 (CA)
Green beans	our garden	40 feet	1,700 (CA)
<u>Total Miles:</u>		<u>90 miles</u>	<u>5,375 miles</u>

Lunch - October 18, 1998

*Roast beef hash made from left over dinner plus other items:

Food Item	Source	Distance Traveled	Distance as if through conventional channels (miles)
Onions	farmers mkt.	10-15 miles	1,700 (CA)
Green bean salad	our garden	40 feet	1,700 (CA)
Purple cabbage	farmers mkt.	10-15 miles	1,700 (CA)
Tomatoes	our garden	40 feet	1,700 (CA)
Yellow peppers	farmers mkt.	10-15 miles	1,700 (CA)
Olive bread	farmers mkt.	10-15 miles	1,700 (CA)
<u>Total Miles:</u>		<u>60 miles</u>	<u>10,200 miles</u>

Table 5. (continued)

Dinner - October 18, 1998

Food Item	Source	Distance Traveled	Distance as if through conventional channels (miles) (CA)
Rice	Buying club	1,700 (CA)	1,700
<i>Stir Fry:</i>			
Mushrooms	Hy-Vee		
	(grocery store)	1,700 (CA)	1,700
Onion	farmers mkt.	10-15 miles	1,700
Green pepper	farmers mkt.	10-15 miles	1,700
Red pepper	farmers mkt.	10-15 miles	1,700
<i>Vegetables</i>			
<i>on Side:</i>			
Brussel sprouts	our garden	40 feet	1,700
<i>Salad:</i>			
Lettuce	our garden	40 feet	1,700
Yellow tomato	our garden	40 feet	1,700
Red tomato	our garden	40 feet	1,700
Basil	our garden	40 feet	1,700
Oregano	our garden	40 feet	1,700
Radish	our garden	40 feet	1,700
Carrots	our garden	40 feet	1,700
Total Miles:		3,445 miles	22,100 miles
Three meal average		1,198 miles	12,558 miles

Adapted from: Where Our Meals Come From
 Kamyar Enshayan and Laura Jackson
 Cedar Falls, Iowa

CA - California
 CO - Colorado
 ID - Idaho

Table 6. Comparison of WASD for food transported to institutions for three Iowa local food system projects with WASD for same food items sourced from conventional system

Project	Local WASD meat and produce (Miles)	Conventional WASD meat and produce (Miles)	Local WASD produce only (Miles)	Conventional WASD produce only (Miles)
Ames - Scheman Conference Center – PFI*	67.3	1,001	38.4	1,233
Iowa City – Johnson Co. Local Food Project	20.8	1,685	20.8	1,685
UNI Local Food Project	43.6	1,719	43.6	1,720
<u>Overall</u>	<u>44.6</u>	<u>1,546</u>	<u>37.9</u>	<u>1,638</u>

Notes:

Food items include apples, broccoli, onions, potatoes, strawberries, tomatoes, green beans, raspberries, salad mix, beef, and chicken. Only Scheman Conference Center included meat; the other two locations were produce only. The town closest to the farm location was used for local estimates. Source locations for the conventional system were towns or cities close to the center of a state known as a significant producer of the food item. For example, California was chosen for strawberries and Idaho for potatoes.

* PFI refers to Practical Farmers of Iowa

Table 7. Energy use and emissions for different modes of freight transport

	Rail	Water	Road	Air
Primary energy consumption KJ/Tonne-km	677	423	2,890	15,839
Specific total emissions g/Tonne-km				
Carbon dioxide	41.0	30.0	207	1,260
Hydrocarbons	0.06	0.04	0.3	2.0
VOC*	0.08	0.1	1.1	3.0
Nitrogen oxide	0.2	0.4	3.6	5.5
Carbon monoxide	0.05	0.12	2.4	1.4

From: Atmosphere Emissions from the Use of Transport in the United Kingdom Volume 2. 1989. The Effect of Alternative Policies. ERR and WWF cited in Whitlegg, J. 1993. Transport for a Sustainable Future: the case for Europe. Bellhaven Press, London.

* Volatile organic compounds

Table 8. Origin of production states used to estimate distances

Produce item	State
Apples	Washington
Asparagus	California
Bell peppers	California
Blackberries	California
Blueberries	Michigan
Broccoli	California
Brussel sprouts	California
Cabbage	Georgia
Carrots	California
Cauliflower	California
Cucumbers	Georgia
Eggplant	Georgia
Grapes	California
Garlic	California
Mushrooms	Pennsylvania
Onions	California
Pears	Washington
Plums	California
Potatoes	Idaho
Radishes	Florida
Raspberries	California
Leaf lettuce	California
Snap beans	Georgia
Spinach	California
Strawberries	California
Sweet Potatoes	Louisiana
Tomatoes	California
Melons	Missouri

Notes:

We elected not to include fresh sweet corn in the calculations because we believe that Iowa sweet corn captures a significant portion of total Iowa fresh sweet corn sales during the summer months.

Per capita consumption of fresh sweet potatoes was estimated to be two-thirds of sweet potatoes for all uses (fresh, frozen, and canned). (Personal communication with Gary Lucier, ERS/USDA, March 2001.)

Table 9. Estimated fuel consumption, CO₂ emissions, and distance traveled for conventional, Iowa-based regional, and Iowa-based local food systems for produce*

Food system and type of truck	Fuel Consumption (gal/year)	\$ value of fuel (current 2001 prices*)	CO ₂ emissions (lbs. / year)	Distance traveled (miles)
Conventional semitrailer	368,102	\$581,601	8,392,727	2,245,423
Iowa regional semitrailer	22,005	\$35,208	501,714	134,230
Iowa regional midsize truck	43,564	\$69,702	993,243	370,289
Iowa local -CSA farmers market small truck (gas)	49,359	\$78,974	967,436	848,981
Iowa local institutional small truck (gas)	88,265	\$141,224	1,729,994	1,518,155

* Diesel fuel prices – U.S. average (\$1.58) used for conventional system and Iowa average (\$1.60) used for Iowa-based regional system. Iowa regular unleaded gasoline average (\$1.60) used for local systems. Web site June 2001 (<http://www.aaa.com/scripts/WebObjects.dll/AAAOnline?association=aaa&club=049>)

Notes:

According to the U.S. Environmental Protection Agency, the most important of the greenhouse gases released through fuel burning and other human activities are CO₂, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. ("Global Warming and Our Changing Climate – FAQ". 2000. Environmental Protection Agency Office of Air and Radiation, April 2000. EPA 430-F-00-011.)

Of these, CO₂ is by far the largest component of emission gases released by diesel fuel trucks, comprising over 99 percent of the emissions by weight. (*Greenhouse Gas Inventory Reference Manual*, Intergovernmental Panel on Climate Change, 1996.)

We estimated the amount of CO₂ released from the burning of diesel fuel and gasoline for these trucks, and we used a conversion factor of 22.8 pounds of CO₂ released from the burning of each gallon of diesel fuel. (Personal communication with Cheryl Bynum and Deb Adler, EPA National Vehicle and Fuel Emissions Laboratory, April 2001.) Calculation—7.12 lb./gal (density of diesel) x 0.874 (percent carbon in diesel) x 44/12 (converting C to CO₂).

We used a conversion factor of 19.6 pounds of CO₂ released from the burning of each gallon of gasoline. (Personal communication with Cheryl Bynum and Deb Adler, EPA National Vehicle and Fuel Emissions Laboratory, April 2001.) Calculation—6.2 lb/gal (density of gasoline) x 0.865 (percent carbon in gasoline) x 44/12 (converting C to CO₂).



COUNTY OF SAN DIEGO

DEPARTMENT OF
AGRICULTURE, WEIGHTS AND MEASURES

2010
CROP STATISTICS
&
ANNUAL REPORT



LISA M. LEONDIS
AGRICULTURAL COMMISSIONER/
SEALER OF WEIGHTS & MEASURES

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Karen Ross, Secretary
California Department of Food and Agriculture
and

The Honorable Board of Supervisors of the County of San Diego

Supervisor Bill Horn, Chairman, 5th District

Supervisor Ron Roberts, Vice-Chairman, 4th District

Supervisor Greg Cox, 1st District

Supervisor Dianne Jacob, 2nd District

Supervisor Pam Slater-Price, 3rd District

I respectfully submit the report of acreage, yield, and value of agricultural production for San Diego County. In 2010, the value of agriculture totaled \$1,652,422,032. This represents a 7% increase from 2009's total of \$1,548,196,332. Although the value increased, the acreage devoted to commercial agriculture decreased slightly by 4,578 acres or -1.5%.

This report also contains detailed crop information and highlights of the many diverse programs within the Department of Agriculture, Weights and Measures that support the County's focus on our children, the environment and safe and livable communities.

Thank you to the many farmers, ranchers, nursery men and women and industry groups who provided information for this report. Additionally, I would like to express my appreciation to the dedicated Agriculture, Weights and Measures staff who continually strive to provide our customers with superior service.

Sincerely,

Lisa M. Leondis
Agricultural Commissioner/
Sealer of Weights and Measures

All reported figures represent Freight on Board (F.O.B.) values for products. These are not net values and do not reflect cost of production. Total values may not add precisely due to rounding. Gross value of farm products does not reflect the total value to the economy.

REMEMBERING HOWARD METCALF



The 2010 crop report is dedicated to Ralph "Howard" Metcalf, Jr., who passed away on October 3, 2010. Howard began as an inspector for the San Diego County Department of Agriculture, Weights and Measures (AWM) in 1965 and rose to the esteemed level of Deputy Agricultural Commissioner before he retired in 1998. Howard's dedication to his profession inspired many young inspectors during his tenure as Deputy over the Plant Health and Pest Prevention, Pest Control, Detection and Integrated Pest Control programs. No detail was

too small with Howard, and he enjoyed sharing his vast knowledge with everyone. Passionate about his work, he soon returned from retirement and worked part-time doing what he loved: inspecting plants for newly emerging pests such as Glass-winged sharpshooters and diseases such as Spotted Oak Blight. Each spring, we looked forward to Howard's return as a "peas-in-a-pod." And now, even though he won't be returning to AWM again, we know Howard is somewhere waiting for us, learning everything there is to know so that when we meet with him again, he can smile and say, "let me show you how to do a nursery inspection here."

2010 SUMMARY OF MAJOR CROPS



The value of Nursery and Cut Flower crops continued to rise in San Diego County in 2010. The number one crop, Ornamental Trees and Shrubs increased in value 14.69% to \$418,841,523. The number two crop, Indoor Flowering & Foliage Plants, increased in value by 0.56% to \$292,500,000. Overall acreage for nurseries and cut flowers increased slightly by 0.05%. The total value for all nursery products (including cut flowers and foliage) was well above the one billion dollar mark for a grand total of \$1,107,558,336.

Overall, Fruit and Nut Crops increased in value 19.33% to \$261,399,642, although decreased in acreage -10.59%. Avocados remain the highest value fruit crop. The value increased by 12.70% to \$147,051,864, even with avocado acreage decreasing significantly by -22.49%. Water played an important role in this change. First, the shortage of water and subsequent increase in water cost resulted in significant avocado acreage taken out of production. Fortunately with the increase in price per ton, growers were able to have some relief from 2009. Growers reported citrus increased both in value by 29.48% and acreage by 5.43%. This increase is partially attributed to the 198% increase in the value of Kumquats.

Vegetables and Vine fruits decreased -9.97% in value and -13.86% in acreage. The largest crop decrease of -80.95% was in Oriental Vegetables due to a reduction in acreage.

Livestock and Poultry increased in value (29.05%) with the largest increase seen in cattle and calves. Ratite products increased (101.52%) largely due to the increase in the value of Emu oil.

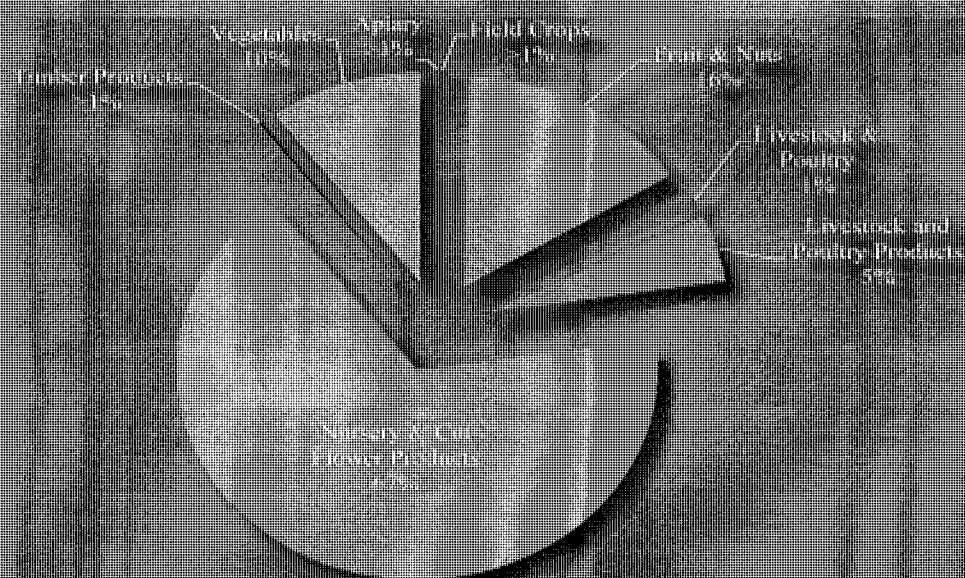
Total Value	\$1,652,422,032
Change in Value from 2009	\$104,225,701
Percent Change	7%
Total Acreage	302,713
Change in Acreage from 2009	-4,578
Percent Change	-1.5%
Highest Value Crop, Per Acre	Indoor Flowering and Foliage Plants
Value Per Acre	\$450,000
Lowest Value Crop, Per Acre	Range
Value Per Acre	\$6

SUMMARY OF MAJOR CATEGORIES

	Year	Acres	Total Value
Total Nursery & Cut Flower Products	2010	12,606	\$1,107,558,336
	2009	11,498	\$1,054,314,220
Total Fruit & Nuts	2010	36,239	\$261,399,642
	2009	40,532	\$219,053,918
Total Vegetables	2010	6,303	\$169,803,464
	2009	7,318	\$188,603,198
Total Field Crops	2010	247,565	\$5,117,287
	2009	247,943	\$5,414,955
Total Apiary	2010		\$2,168,007
	2009		\$2,055,545
Total Timber Products	2010		\$778,527
	2009		\$757,474
Total Livestock & Poultry	2010		\$20,472,006
	2009		\$15,863,725
Total Livestock and Poultry Products	2010		\$85,124,763
	2009		\$62,133,298
Grand Totals	2010	302,713	\$1,652,422,032
	2009*	307,291	\$1,548,196,332

*2009 total changed due to corrections made in apiary

MAJOR CROP PERCENTAGES

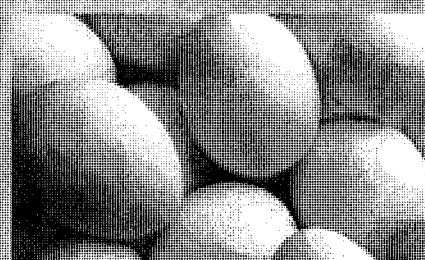
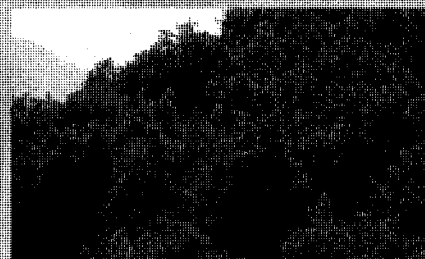
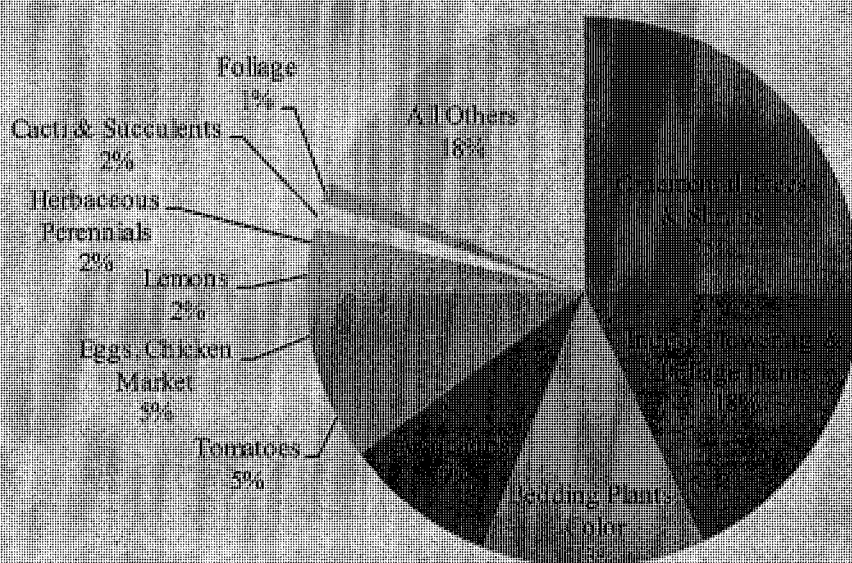


2010 TOP TEN CROPS

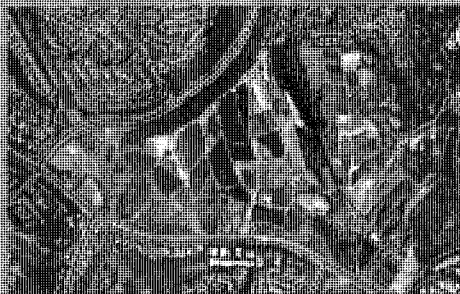


Crop	Value
Ornamental Trees & Shrubs	\$418,841,523
Indoor Flowering & Foliage Plants	\$292,500,000
Bedding Plants, Color	\$214,941,018
Avocados	\$147,051,864
Tomatoes	\$86,774,565
Eggs, Chicken Market	\$75,904,920
Lemons	\$39,885,636
Herbaceous Perennials	\$26,235,355
Cacti & Succulents	\$25,153,520
Foliage	\$19,986,120

TOP TEN CROPS



WHAT MAKES SAN DIEGO COUNTY AGRICULTURE UNIQUE....



San Diego County is the most southwestern county in the continental United States with a geographic area of 4,200 square miles, approximately the size of Connecticut, and a population of more than 3 million.

The National Weather Service describes the San Diego climate as the most nearly perfect in America, characterized as Mediterranean, with warm winters and cool summers.



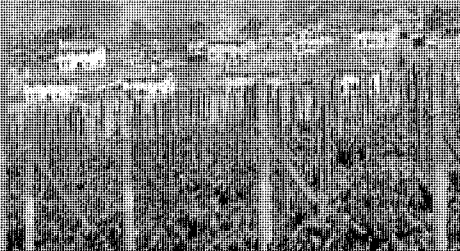
San Diego County's varied topography creates a wide fluctuation of microclimates resulting in nearly 30 different types of vegetation communities. This diversity allows for San Diego to grow over 200 different agricultural commodities - from strawberries along the coast, apples in the mountain areas, to palm trees in the desert.

San Diego County has the 5th* highest urban population among counties in the United States, and the 17th* largest agricultural economy. (*updated)



Agriculture in San Diego County covers 302,713 acres and is a key contributor to San Diego County's economy, along with defense, manufacturing, tourism and biotechnology.

San Diego County has 6,687 farms, more than any other county in the United States. 68% of San Diego County farms are 1-9 acres. Nearly 27% of farms in San Diego County are operated by women.



The high cost of water and land make farming in San Diego County expensive and encourages growers to raise products with a high dollar value per acre. San Diego produces the highest dollar value per acre of any county in California!

The median size farm is just 4 acres and yet our county's farmers rank number one in both California and the nation in the production value of nursery, floriculture and avocados.



Statewide, San Diego County is in the top five counties for cucumbers, mushrooms, tomatoes, boysenberries, strawberries, grapefruit, Valencia oranges, tangelos and tangerines, honey, and eggs.

San Diego County farmers produce 44 crops valued at over \$1 million dollars annually.

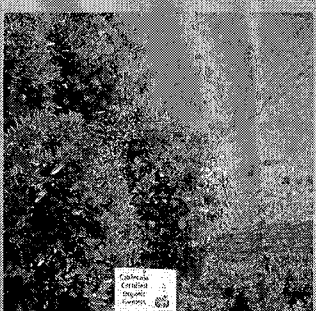
NURSERY AND CUT FLOWER CROPS

Crop	Year	Acres	Total
Bedding Plants, Color	2010	937	\$214,941,018
	2009	941	\$227,796,845
Bulbs, Corms, Rhizomes, Roots, Tubers	2010	58	\$5,842,456
	2009	57	\$5,643,000
Cacti & Succulents	2010	280	\$25,153,520
	2009	275	\$23,640,375
Citrus, Avocado, & Subtropical Fruit Trees	2010	280	\$15,351,996
	2009	279	\$15,297,167
Herbaceous Perennials	2010	373	\$26,235,355
	2009	374	\$26,340,718
Indoor Flowering & Foliage Plants	2010	650	\$292,500,000
	2009	646	\$290,880,000
Ornamental Trees & Shrubs	2010	5,283	\$418,841,523
	2009	4,518	\$365,203,494
Poinsettia	2010	155	\$19,375,000
	2009	156	\$19,500,000
Turf and Cut Christmas Trees	2010	709	\$12,000,000
	2009	709	\$12,082,069
Total Nursery Products	2010	8,725	\$1,030,240,868
	2009	7,955	\$986,383,668



Crop	Year	Acres	Total
Leptospermum	2010	398	\$2,984,016
	2009	400	\$3,000,400
Proteas	2010	571	\$4,436,233
	2009	565	\$4,237,500
Wax Flowers	2010	780	\$4,685,460
	2009	783	\$5,448,114
Other Cut Flowers	2010	1,292	\$45,225,640
	2009	960	\$35,372,832
Foliage	2010	840	\$19,986,120
	2009	835	\$19,871,706
Total Flower Products	2010	3,881	\$77,317,469
	2009	3,543	\$67,930,552
Total Nursery & Cut Flower Products	2010	12,606	\$1,107,558,336
	2009	11,498	\$1,054,314,220

FRUIT & NUT CROPS



Crop	Year	Acres	Tons/ Acre	Tons Total	US \$/ Ton	Total
Apples	2010	286	1	372	\$730	\$271,414
	2009	266	1	346	\$496	\$171,517
Total Avocados	2010	19,133	4	81,467		\$147,051,864
	2009	24,684	2	45,779		\$130,478,067
Hass	2010	17,621	4	77,637	\$1,806	\$140,190,413
	2009	22,896	2	40,660	\$2,844	\$115,618,818
Lamb-Hass	2010	1,031	3	3,088	\$1,994	\$6,156,152
	2009	998	4	4,368	\$3,121	\$13,630,488
Other	2010	481	2	742	\$951	\$705,298
	2009	790	1	752	\$1,634	\$1,228,761
Berries, Misc.	2010	369	7	2,399	\$4,615	\$11,069,078
	2009	216	6	1,296	\$4,000	\$5,184,000
Total Citrus	2010	14,287	13.6	194,559		\$78,482,839
	2009	13,550	14	190,193		\$60,615,936
Total Grapefruit	2010	1,750	21	36,750		\$14,332,500
	2009	1,747	24	41,935		\$12,926,451
Fresh Market	2010		18	27,563	\$502	\$13,836,375
	2009		18	31,451	\$382	\$12,014,366
Byproduct	2010		3	9,188	\$54	\$496,125
	2009		6	10,484	\$87	\$912,085
Kumquats	2010	137	6	822	\$3,500	\$2,877,000
	2009	224	3	591	\$1,632	\$965,100
Total Lemons	2010	4,456	16	71,288		\$39,885,636
	2009	3,486	18	62,748		\$32,419,800
Fresh Market	2010		14	62,377	\$625	\$38,985,625
	2009		15	52,290	\$600	\$31,374,000
Byproduct	2010		2	8,911	\$101	\$900,011
	2009		3	10,458	\$100	\$1,045,800
Total Limes	2010	408	10	3,876		\$1,378,224
	2009	310	11	3,255		\$1,016,025
Fresh Market	2010		7	2,856	\$454	\$1,296,624
	2009		7	2,015	\$455	\$916,825
Byproduct	2010		3	1,020	\$80	\$81,600
	2009		4	1,240	\$80	\$99,200

FRUIT & NUT CROPS

Crop	Year	Acres	Tons/ Acre	Tons Total	US \$/ Ton	Total
Total Navel	2010	1,175	17	19,740		\$5,879,935
	2009	1,200	14	16,452		\$3,484,800
Fresh Market	2010		11	12,925	\$379	\$4,898,575
	2009		9	10,800	\$260	\$2,808,000
Byproduct	2010		6	6,815	\$144	\$981,360
	2009		5	5,640	\$120	\$676,800
Total Valencia	2010	5,282	9	47,538	\$204	\$9,681,906
	2009	5,500	9	50,050	\$115	\$5,775,000
Fresh Market	2010		7	36,974	\$237	\$8,762,838
	2009		7	38,500	\$138	\$5,313,000
Byproduct	2010		2	10,564	\$87	\$919,068
	2009		2	11,550	\$40	\$462,000
Total Tangerines	2010	1,079	13	14,545		\$4,447,638
	2009	1,083	14	15,162		\$4,028,760
Fresh Market	2010		12	12,948	\$319	\$4,130,412
	2009		12	12,996	\$293	\$3,807,828
Byproduct	2010		2	2,158	\$147	\$317,226
	2009		2	2,166	\$102	\$220,932
Grapes, Wine	2010	447	2	760	\$1,033	\$784,977
	2009	489	2	734	\$1,204	\$883,134
Macadamia Nuts	2010	67	1	67	\$2,397	\$160,599
	2009	70	1	49	\$3,000	\$147,000
Misc. Fruit & Nuts	2010	982				\$7,203,952
	2009	724				\$5,311,264
Persimmons	2010	421	4	1,768	\$600	\$1,060,920
	2009	300	7	2,190	\$500	\$1,095,000
Total Strawberries	2010	247	31	7,657	\$2,000	\$15,314,000
	2009	233	30	6,990		\$15,168,000
Fresh Market	2010		31	7,000	\$1,600	\$11,200,000
	2009		18	8,190	\$1,600	\$13,104,000
Processing	2010		0	657	\$400	\$262,800
	2009		12	5,160	\$400	\$2,064,000
Total Fruit & Nuts	2010	36,239				\$261,399,642
	2009	40,532				\$219,053,918



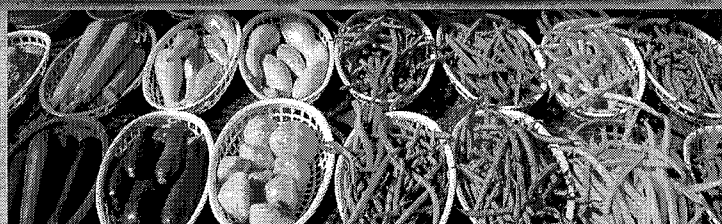
VEGETABLE CROPS

Crop	Year	Acres	Tons /Acre	Tons	US \$ /Ton	Total
Beans, Snap	2010	299	5	1,615	\$1,400	\$2,260,440
	2009	398	5	2,149	\$1,440	\$3,094,848
Bunch Vegetables*	2010	462				\$4,072,530
	2009	473				\$4,169,495
Corn, Sweet	2010	153	3	497	\$1,000	\$497,250
	2009	143	3	429	\$1,440	\$617,760
Cucumbers	2010	266	22	5,847	\$582	\$3,405,528
	2009	299	23	6,728	\$640	\$4,305,600
Herbs	2010	380	11	4,256	\$4,028	\$17,143,168
	2009	467	12	5,417	\$3,827	\$20,731,624
Lettuce	2010	575	11	6,095	\$412	\$2,511,140
	2009	580	11	6,380	\$403	\$2,571,140
Melons	2010	204	4	816	\$400	\$326,400
	2009	167	5	835	\$400	\$334,000
Mushrooms	2010	28	155	4,296	\$2,861	\$12,291,628
	2009	39	142	5,534	\$3,260	\$18,041,166
Oriental Vegetables**	2010	12				\$98,424
	2009	63				\$516,726
Peppers	2010	173	18	3,114	\$1,000	\$3,114,000
	2009	176	19	3,300	\$1,000	\$3,300,000
Potatoes	2010	203	15	3,045	\$291	\$886,095
	2009	728	13	9,486	\$301	\$2,855,238
Squash	2010	486	11	5,249	\$390	\$2,047,032
	2009	418	11	4,389	\$384	\$1,685,376
Tomatoes	2010	2,296	42	96,202	\$902	\$86,774,565
	2009	2,267	45	101,448	\$900	\$91,303,425
Misc. Vegetables***	2010	767				\$34,375,264
	2009	1,100				\$35,076,800
Total Vegetables	2010	6,303				\$169,803,464
	2009	7,318				\$188,603,198

*Includes collards, green onions, mustard and turnip greens, parsley, radishes, and spinach

**Includes bok choy and asian greens

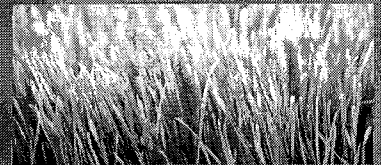
***Includes cauliflower, celery, chayote, tomatillos and others



FIELD AND SPECIALTY CROPS

Crop	Year	Acres	Tons /Acre	Tons Total	US \$ /Ton	Total
Barley, Grain	2010	670	1	335	\$170	\$56,950
	2009	700	0	60	\$100	\$6,000
Greenchop	2010	24	20	480	\$48	\$23,040
	2009	30	20	600	\$20	\$12,000
Hay, Oat	2010	4,793	1	4,793	\$200	\$958,600
	2009	5,043	1	7,060	\$163	\$1,147,283
Pasture, Irrigated	2010	1,422				\$2,674,127
	2009	1,513				\$2,844,816
Range	2010	240,630				\$1,395,653
	2009	240,630				\$1,395,653
Silage*	2010	26	13	340	\$26	\$8,917
	2009	27	13	351	\$26	\$9,203
Total Field Crops	2010	247,565				\$5,117,287
	2009	247,943				\$5,414,955

*Correction made to 2009 Silage total



TIMBER CROPS

Crop	Year	Total
Timber	2010	\$8,527
	2009	\$7,474
Firewood	2010	\$770,000
	2009	\$750,000
Total Timber Products	2010	\$778,527
	2009	\$757,474

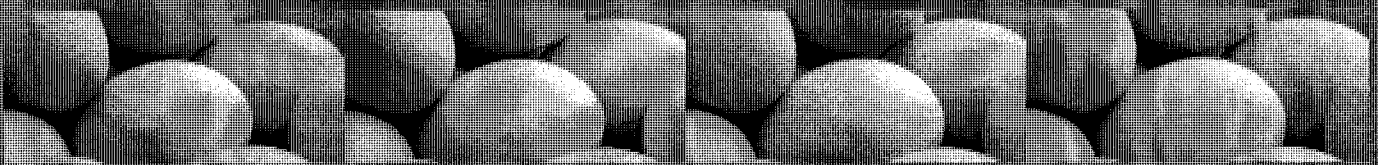
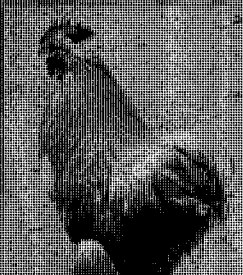
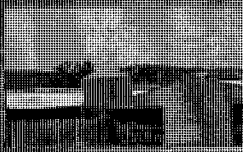


APIARY CROPS

Crop	Year	Total
Honey	2010	\$800,464
	2009	\$589,015
Bees Wax	2010	\$45,943
	2009	\$9,200
Bees & Queens	2010	\$101,600
	2009	\$80,500
Pollen	2010	\$70,000
	2009*	\$65,000
Pollination	2010	\$1,150,000
	2009	\$1,311,830
Total Apiary	2010	\$2,168,007
	2009	\$2,055,545

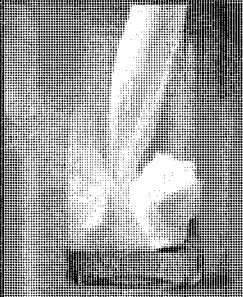
*Pollen value was corrected for 2010 report

LIVESTOCK & POULTRY



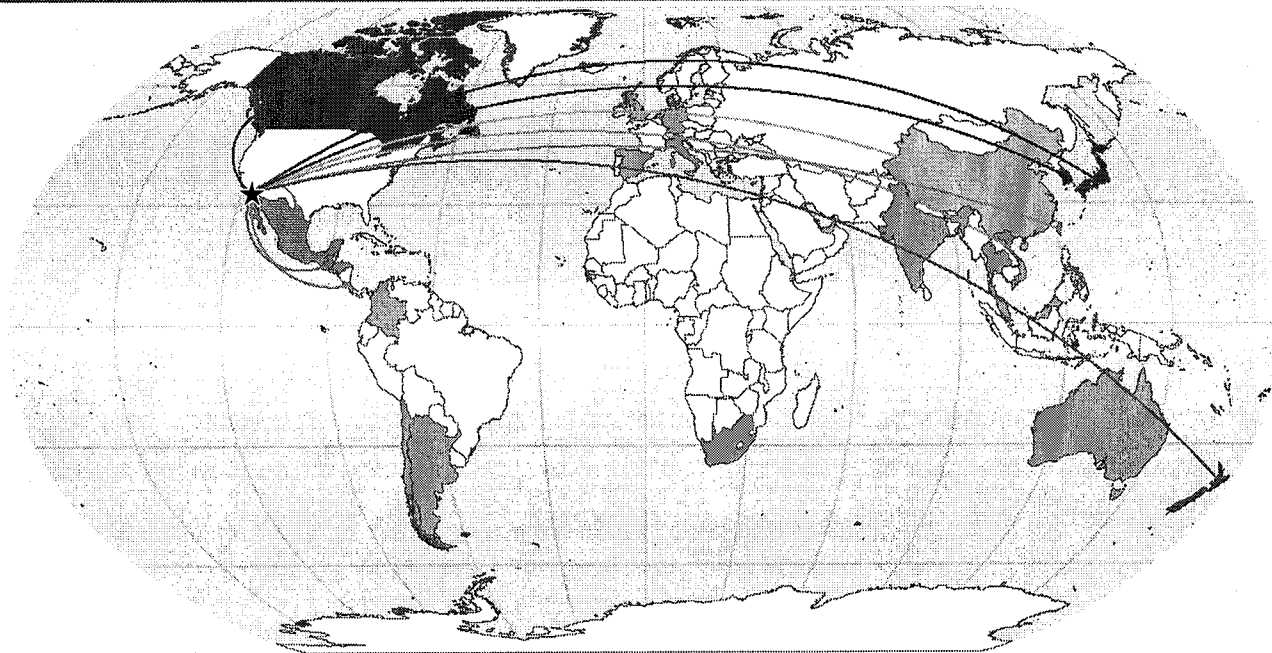
	Year	Number of Head	Total Weight CWT*	US \$ /CWT	Total
Cattle and Calves	2010	17,000	153,000	\$106	\$16,248,600
	2009	17,000	127,500	\$92	\$11,768,250
Hogs and Pigs	2010	640	1,600	\$55	\$87,840
	2009	800	2,000	\$42	\$84,600
Chickens	2010				\$1,353,255
	2009				\$1,070,400
Ratites Meat	2010				\$0
	2009				\$3,500
Lambs and Sheep	2010	1,000	1,000	\$76	\$75,800
	2009	1,000	1,000	\$60	\$59,900
Miscellaneous	2010				\$2,706,510
	2009				\$2,877,075
Total Livestock & Poultry	2010				\$20,472,006
	2009				\$15,863,725

LIVESTOCK & POULTRY PRODUCTS



Product	Year	Number	Total Weight CWT	US \$/ Unit	Total
Milk, Market	2010		536,724	\$15	\$7,889,843
	2009		546,072	\$12	\$6,285,298
Eggs, Chicken Market	2010	83,412,000 dz		\$1	\$75,904,920
	2009	76,650,000 dz		\$1	\$55,188,000
Ratite Products Total	2010	1,000 gal			\$1,330,000
	2009	1,100 gal			\$660,000
Ratite Oil	2010	1,000 gal		\$1,330	\$1,330,000
	2009	1,100 gal		\$600	\$660,000
Total Livestock and Poultry Products	2010				\$85,124,763
	2009				\$62,133,298

INTERNATIONAL TRADING PARTNERS

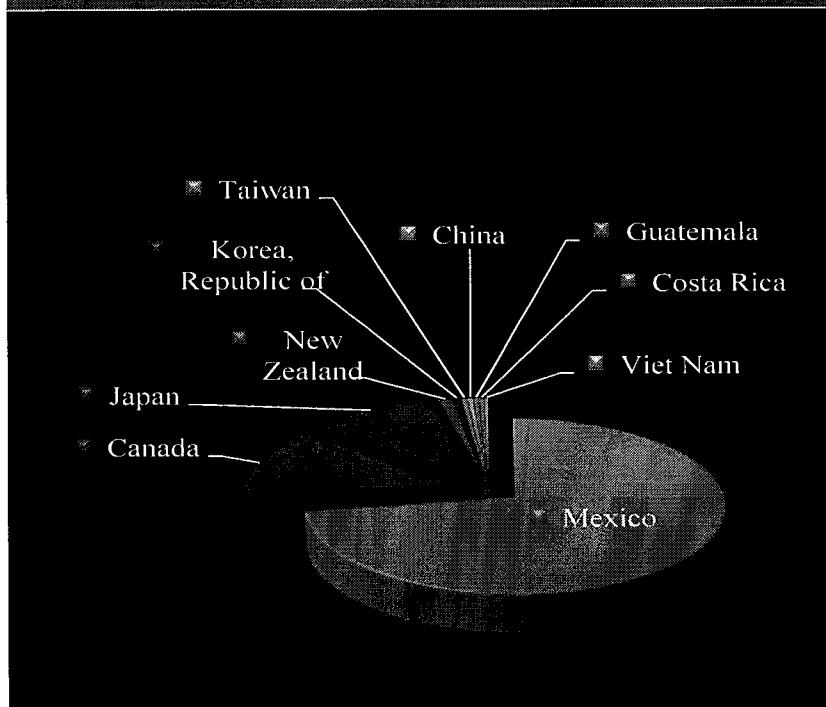


Mexico 4769 shipments	Japan 686 shipments	South Korea 39 shipments	China 28 shipments	Costa Rica 25 shipments
Canada 877 shipments	New Zealand 70 shipments	Taiwan 30 shipments	Guatemala 26 shipments	Vietnam 21 shipments

Total Number of Countries: 47
Total Number of Shipments: 6,750

■ Countries with 1 - 13 Shipments
★ San Diego County

SAN DIEGO'S TOP TEN TRADING PARTNERS

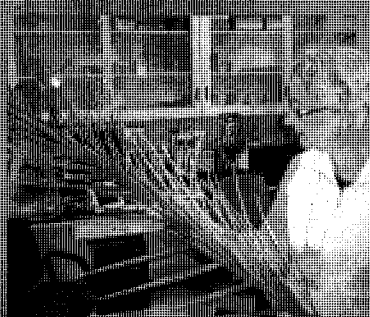
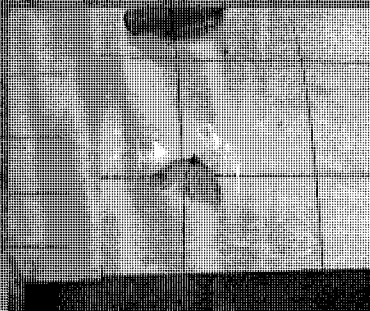


Country	% of Total Shipments
Mexico	73%
Canada	13%
Japan	10%
New Zealand	1%
South Korea	1%
Taiwan	1%
China	1%
Guatemala	<1%
Costa Rica	<1%
Vietnam	<1%

SUSTAINABLE AGRICULTURE

Sustainable Agriculture promotes the economic viability of agriculture while preserving natural resources and the environment. Pest prevention activities are essential to inhibiting the spread of exotic pests and ensuring a sustainable agricultural industry in California.

The Department of Agriculture, Weights and Measures administers programs for the detection, control and eradication of insect pests, plant diseases and invasive weeds, as well as for the enforcement of quarantines to prevent the spread of invasive pests.



A - Rated Pest Finds	Number Found
<i>Allopeas clavulinum</i> , allopeas snail	4
<i>Aulacaspis yasumatsui</i> , cycad aulacaspis scale	2
<i>Ceroplastes rubens</i> , red wax scale	3
<i>Ceroplastes rusci</i> , fig wax scale	1
<i>Epiphyas postvittana</i> , light brown apple moth	6
Family Subulinidae, subulinid snail	5
<i>Fusarium oxysporum</i> f. sp., palm wilt	2
<i>Pinnaspis buxi</i> , boxwood scale	1
<i>Pinnaspis strachani</i> , lesser snow scale	12
<i>Pseudaulacaspis cockerelli</i> , magnolia white scale	33
<i>Solenopsis invicta</i> , red imported fire ant	7

Q - Rated Pest Finds	Number Found
Cicadellidae, egg masses, sharpshooter	1
Coccidae, wax scale	1
<i>Dialeurodes schefflerae</i> , schefflera whitefly	3
Family Diaspididae, armored scale	3
Family Orthalicidae, snail	1
Family Pseudococcidae, mealybug	10
Family Subulinidae, subulinid snail	5
Family Veronicellidae, slug	1
<i>Kallitaxila granulata</i> , planthopper larva	1
<i>Paracoccus solani</i> , agave mealybug	1
<i>Pheidole megacephala</i> , bigheaded ant	4
<i>Phenacoccus</i> sp., mealybug	1
<i>Planococcus minor</i> , Pacific mealybug	1
<i>Riparsiella hibisci</i> , root mealybug	4
thrips	2
<i>Uromyces transversalis</i> , gladiolus rust	1
<i>Vinsonia stellifera</i> , stellate scale	1
<i>Zachrysia provisoria</i> , Cuban land snail	4

SUSTAINABLE AGRICULTURE

DOG TEAM INSPECTIONS



Commercial Shipping Locations*	labeled Packages with Plant Material Found	Unlabeled Packages with Plant Material Found
Location 1	2,741	260
Location 2	2,345	105
Location 3	1,465	66
Location 4	416	21
Location 5	220	33
Location 6	900	72
Location 7	792	62
Location 8	1692	128
Totals	10571	747

*Dog Teams routinely inspected packages at 8 locations

ORGANIC FARMING

San Diego County is at the forefront of organic farming with 368 registered organic producers. In 2010, San Diego organic growers produced over 140 different crops, from the usual oranges and avocados to the unusual such as jujube and Feijoa. The USDA's National Organic Standards Board defines "organic agriculture" as an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain, and enhance ecological harmony.

San Diego County's Top Ten Organically Produced Crops

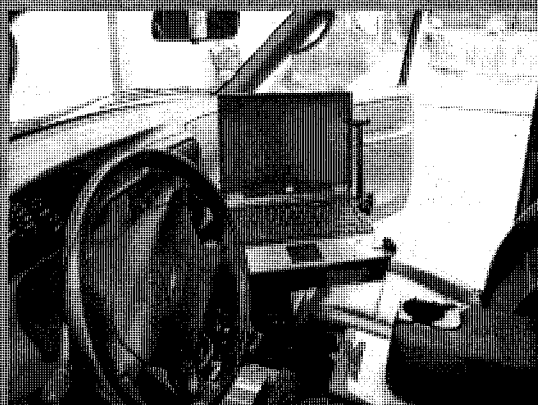
Crop	Acres	Crop	Acres
1. Avocados	2,236	6. Chard	133
2. Oranges	1,282	7. Cucumber	72
3. Lemon	889	8. Bean	60
4. Grapefruit	450	9. Persimmon	42
5. Tangelo/ Tangerine	207	10. Squash	41

INVASIVE WEED CONTROL

Weed	Rating	Removal Method	Scope of Treatment
Spotted knapweed, <i>Centaurea maculosa</i>	A	Hand Removal	1 site, 7.7 acres
Purple loosestrife, <i>Lythrum salicaria</i>	B	Herbicides/Hand Removal	1 site, 1 acre
Perennial pepperweed, <i>Lepidium latifolium</i>	B	Herbicides	43 sites, 202 acres
Tamarisk, <i>Tamarix parviflora</i>	B	Herbicides	1 site, 20.6 acres
Yellow starthistle, <i>Centaurea solstitialis</i>	C	Herbicides/Hand Removal	10 sites, 39.8 acres

A NEW WAY OF DOING BUSINESS

By taking advantage of new technology, San Diego County Department of Agriculture, Weights and Measures (AWM) has embarked on a journey of transforming how we do business. Our goal is to increase efficiency to better serve our customers while safeguarding agriculture, consumers and the environment. In 2010, we worked to achieve our goal by implementing the following:

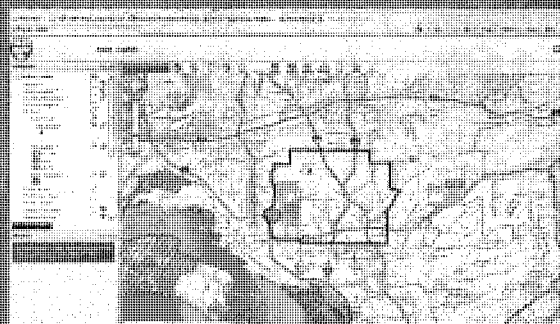


Government Without Walls: AWM implemented a new field inspection data system. This system tracks all inspections, eliminates costly time for staff to re-enter data into computers from inspection forms, and provides managers with real-time information on program productivity. This allowed AWM to conduct a pilot project called "Government Without Walls" (GWOW). GWOW supports a mobile worker model, which reduces the amount of time inspectors spend driving to and from the office, as well as time in the office. Our initial results in the Weights and Measures program showed a 31% higher productivity for GWOW inspectors.



Second Detector Dog Team: Funding through Section 10291 of the Farm Bill, The Plant Pest and Disease Management and Disaster Prevention fund, allowed AWM to add a second detector dog team. Success with our first

detector team, consisting of Friday and handler Jeremy, resulted in San Diego County being awarded a contract for a second dog team, Drake and handler Ted. With two dog teams, we inspected more locations finding more packages of unmarked fruit and plants. Last year Drake, Friday and their handlers inspected 40,571 marked parcels, found 747 unmarked parcels containing fruit and plants and issued 445 Notices of Rejection. Packages of illegal plant products represent a route of entry for unwanted, damaging pests.



Increased Efficiency of Mapping: Our web-based Geographic Information System (GIS) was upgraded increasing the efficiency of mapping and special analysis of AWM activities. This upgrade allowed AWM staff to customize maps for quarantines, pesticide applications, insect trapping, nursery inspections, verification of commercial agriculture, various weights and measures activities, as well as any emergency event. This improved system was instrumental in the mapping of several significant quarantines, allowing for spatial information to be shared with staff as soon as boundaries were determined.

USDA Phytosanitary Certification Issuance and Tracking (PCIT): Another technological advancement is the use of the electronic USDA PCIT program in cooperation with United States Department of Agriculture. The PCIT program assures phytosanitary certificates reach their destination with the shipment and are recoverable if lost, unlike the old paper copies. This system also allows AWM to collect fees online, eliminating the need for trust accounts and for AWM inspectors to return to the office every day to deposit money. PCIT charges are electronically submitted to USDA and AWM receives a monthly itemized account of the certificates issued.

PROGRAMS AND SERVICES

Agricultural Water Quality performs inspections at nurseries, greenhouses, golf courses, cemeteries, and pest control businesses ensuring compliance with the County's Stormwater Permit, mandated by the San Diego Regional Water Quality Control Board. Inspections, education, and investigations are aimed at stopping the potential for discharging pollutants such as fertilizers, pesticides, and sediment into local waterways. Highlights for 2010 include:

- 362 inspections completed
- 28 complaints investigated

Civil Actions advocates for the department on actions brought against a person or businesses due to violations found through inspections. Number of cases for 2010:

- 21 Certified Farmers' Markets
- 370 Weights & Measures (including scanners)
- 36 Agricultural and 39 Structural Pesticides
- 2 Quarantine Compliance

Integrated Pest Control works under the Board of Supervisors' policy mandating an integrated pest management (IPM) approach when using pesticides at all county facilities. Mechanical methods are used whenever possible in the control of invasive weeds and structural pest control. Highlights for 2010 include:

- 2,928 acres of weed control performed on county roadside rights of way, airports, landfills, parks, water pollution control facilities, and flood control sites
- 98 acres of invasive weeds treated with herbicides
- 7.7 acres of mechanical weed removal
- 613 acres surveyed for invasive weeds
- American Recovery and Reinvestment Act funding (ARRA) provided for the treatment of all 52 known exotic invasive weed sites within the county

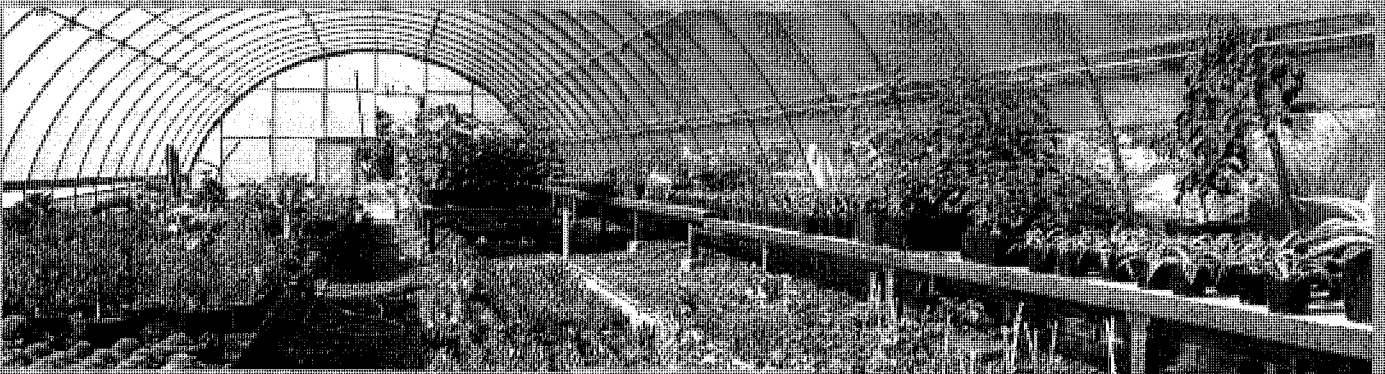
- 156 County facilities treated for structural pests
- 21,867 pounds of rodent bait manufactured

Entomology and Plant Pathology Labs provide rapid insect and plant disease identification allowing a quick response in the fight against pests. Highlights for 2010:

- Entomology lab determined 38,506 insect samples
- Plant Pathology Lab processed 7,341 samples
- Other notable finds in addition to A and Q finds on page 13 include: *Phytophthora foliorum* (B) on azalea; guava rust *Puccinia psidii* (B) found for the first time on Melaleuca in California; and downy mildew, *Peronospora radii* (C) found for the first time on chrysanthemum in San Diego

Pesticide Regulation enforces state laws and regulations. Inspections, complaint and illness investigations, and evaluations of restricted material permits all serve to ensure pesticides are used in a safe and effective manner while protecting human and animal health and the environment. Highlights for 2010 include:

- Received the highest possible Effectiveness Evaluation Rating from the California Department of Pesticide Regulation
- Hosted the San Diego Structural Fumigation Enforcement Committee meetings
- Held 31 outreach sessions for regulated industries
- Developed Bee Protection Practice Guidelines
- Developed Pesticide Drift Plan for exposures resulting from a pesticide drift incident
- Prosecuted an unlicensed structural pest control company using agricultural pesticides around homes
- Successfully revoked the license of a structural pest control company with numerous safety violations



Environmental Services prepares crop information, provides agricultural expertise for land use projects, performs verification of agriculture inspections for farm worker housing, coordinates media and outreach, and maintains AWM's website.

Plant Health and Pest Prevention is the first line of defense in keeping unwanted pests out of our county. Inspections of incoming and outgoing plant shipments and production nurseries look for pests harmful to agricultural production here or at the shipment destination.

Highlights for 2010:

- 11,968 shipments inspected with 101 pest finds
- 747 unmarked parcels intercepted by Dog Teams containing plant material, 8 with actionable pest finds
- 320 nurseries comprising 5,482 acres inspected for sudden oak death disease, *Phytophthora ramorum*
- 517 nurseries inspected comprising 8,673 acres

Pest Detection is a critical component of our statewide

pest prevention network and is our county's second line of defense against the introduction and spread of insect pests, such as exotic fruit flies, Japanese beetle, and Gypsy moth. 261,050 trap inspections were conducted in 2010.

Standards Enforcement protects consumers by testing commercial weighing and measuring devices, performing price verification on Point-of-Sale systems (scanners), inspecting certified producers and farmers' markets and conducting organic registrations and shell egg quality inspections. Highlights for 2010:

- 47,269 commercial weighing and measuring devices inspected, 94.5% were in compliance
- 48 active farmers' markets and 193 local growers certified in San Diego County
- 368 growers registered as organic
- 309 inspections at 164 egg facilities
- 373 consumer complaints investigated regarding commercial meters, petroleum, and price overcharges



OUR SAN DIEGO OFFICES HAVE MOVED!

Our new address: 9325 Hazard Way, Suite 100, San Diego, CA 92123
(The San Marcos office is at the same location).

Main Phone: (858) 694-2739

Website: www.sdcawm.org

Email: sdcawm@sdcountry.ca.gov

Program	Services	Number
Agricultural Water Quality	Stormwater, agricultural hazardous material storage	(858) 694-8980
Entomology	Insect identification; apidary registration; pest surveys	(858) 614-7738
Environmental Services	Crop statistics; land use issues; public information	(858) 614-7770
Integrated Pest Control	Invasive weed control	(858) 614-7750
Plant Health & Pest Prevention	Licenses to sell nursery products, flowers, & foliage; shipping certificates;	(760) 752-4700
	Inspections: incoming/outgoing shipments; nursery; glassy-winged sharpshooter; sudden oak death	Inspection Request Line (760) 752-4713
Pest Detection	Exotic insect trapping/eradication	(858) 614-7770 (800) 300-TRAP
Pesticide Regulation	Voluntary compliance inspections; registration; operator identification numbers; pesticide use reporting; restricted materials permits; employee pesticide training requirements; pesticide complaints	(858) 694-8980
Plant Pathology	Plant disease diagnostic services; plant disease surveys	(858) 614-7734
Standards Enforcement	Certified farmers' markets; certified producer certificates; organic handler/producer; egg producer/handler; scanner registration; commercial weighing & measuring devices; device serviceperson; weighmaster	(858) 694-2778

The 2010 Crop Statistics and Annual Report was produced by Deputy Agricultural Commissioner/Sealer Dawn Nielsen and Senior Agricultural Standards Inspector Colleen Carr with assistance from GIS Analyst John Taylor. Cover photo by Deputy Agricultural Commissioner/Sealer Karen Melvin.

DEPARTMENT PERSONNEL 2010

Robert G. Atkins

Agricultural Commissioner, Sealer of Weights & Measures

Sandy Parks
Deputy Director

Lisa Leonidis
Assistant Director

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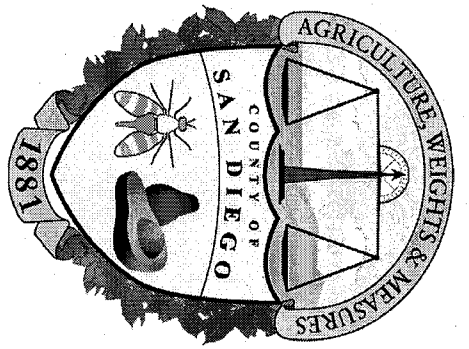
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Organic Farming

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San Diego County has always been at the forefront of organic farming. The county has 347 growers registered as organic. In 2011, San Diego County organic growers produced over 150 different crops on 6,700 acres. Crop varieties range from the usual such as oranges, grapes, and avocados to the unusual like cherimoyas, loquats, and jujubes.



The majority of organic produce grown locally is sold to wholesalers who in turn sell it to markets all the way from San Francisco to New York City. A portion of the produce is sold directly to local restaurants and natural food stores. Organic growers also sell directly to the public through produce stands, Certified Farmers' Markets throughout the County of San Diego, and Community Supported Agriculture (CSA) programs. Members of a CSA program receive boxes of fresh organic fruits and vegetables delivered throughout the year for a weekly or annual fee.

The **California Organic Products Act of 2003** was created at the request of the organic food industry with the goal of protecting producers, handlers, processors, retailers, and consumers of organic foods sold in California. The law amended existing California organic law to conform with the requirements of the **National Organic Program (NOP)** and enforced labeling requirements relating to "organic" claims for fresh agricultural products.

The law divides the oversight responsibilities between the **Department of Health Services (DHS)** which is responsible for processed food products, cosmetics and pet food, and the California **Department of Agriculture (CDFA)** which is responsible for raw agricultural commodities, meat, poultry, and dairy products. The County Agricultural Commissioners work with CDFA's Organic Program in registering organic growers, enforcing applicable organic laws and regulations, and investigating consumer complaints regarding organic products.

The production of organic produce is one of the fastest-growing categories in the food industry today. In 2005, nearly two-thirds of U.S. consumers bought organic foods and beverages, up from about half in 2004. During the past decade, U.S. sales have grown 20 percent or more annually. Organic food and beverage sales nationally are estimated to have topped \$15 billion in 2004. Sales are projected to more than double by 2009.

[Frequently Asked Questions](#)

[Organic Registration Information and Application](#)

[Letter from CDFA to Organics Industry Regarding Mediation and Appeal Procedures](#)

[National Organic Certification Cost Share Program](#)

[Organic Food Complaint Form](#)

So what can the public count on when they buy products labeled as organic?

Organic fruits and vegetables are grown using only botanical or primarily non-synthetic pest controls. Fertilizers made with sewage sludge or synthetic ingredients allowed in most conventional food production cannot be used. No genetically engineered modification or irradiation is permitted. All organic products sold in the U.S. must comply with the Organic Food Production Act of 1990. Organic products sold in California must also comply with the California Organic Products Act of 2003.

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CHAPTER 5 **Conservation and Open Space Element**



Introduction

Purpose and Scope

The primary focus of the Conservation and Open Space Element is to provide direction to future growth and development in the County of San Diego with respect to the following:

- The conservation, management, and utilization of natural and cultural resources
- The protection and preservation of open space
- The provision of park and recreation resources

Open space is defined as any parcel or area of land or water that is essentially unimproved and devoted to open space use. There is not a specific Open space section in this Element. Open space issues are addressed in every section of this document.

Population growth and development continually require the use of both renewable and nonrenewable resources. Goals and policies provided in this General Plan Element are divided into nine sections that address the following:

- *Biological Resources*—Land use-based conservation goals and policies that protect the ecological and lifecycle needs of threatened, endangered, or otherwise sensitive species and their associated habitats.
- *Water Resources*—Conserve and efficiently use water and protect the groundwater aquifer, water bodies, and water courses, which include reservoirs, rivers, streams, and the watersheds located throughout the region.
- *Agricultural Resources*—Minimize land use conflicts, preserve agricultural resources, and support the long-term presence and viability of agricultural industry as an important component of the region's economy and open space linkage.
- *Cultural Resources*—Federal and State legislation such as the *National Environmental Policy Act* (NEPA), *National Historic Preservation Act* (NHPA), and *California Environmental Quality Act* (CEQA) establish requirements to ensure cultural resources are protected and preserved. This section supplements this legislation with goals and policies that set the framework for local ordinances and regulations that protect these important cultural resources.
- *Paleontological Resources and Unique Geologic Features*—Preserve the County's rich geologic and paleontological history by establishing achievable land-use-based goals and policies.
- *Mineral Resources*—Manage the remaining mineral deposits while striving to ensure that adequate resources are available to support the economic prosperity of future generations of San Diego County residents.
- *Visual Resources*—Protect scenic corridors, geographically extensive scenic viewsheds, and dark skies within the natural environment.
- *Air Quality, Climate Change, and Energy*—Reduce the emissions of criteria air quality pollutants, emissions of greenhouse gases, and energy use in buildings and infrastructure, while promoting the use of renewable energy sources, conservation, and other methods of efficiency.

INTRODUCTION

- *Park and Recreation Facilities*—Ensure that adequate park and recreational facilities will adequately serve current and future residents.

Guiding Principles for Conservation and Open Space

The Guiding Principles for the General Plan are introduced in Chapter 2. Guiding Principles 3, 4, 7 and 8 are relevant to the Conservation and Open Space Element. The conservation of natural resources and the preservation of open space are essential actions required to realize the overall vision of this General Plan, along with the achievement of the County's strategic initiatives.

The Conservation and Open Space Element establishes goals, policies, and programs that value and protect natural resources to ensure they are available for the future. Primary objectives of the Conservation and Open Space Element are to preserve the diverse range of visual, natural, and cultural resources that exemplify the County. The Element strives to minimize the impact of future development in areas with significant visual, natural, and cultural resources and supports the creation and enhancement of important habitat preserves and open space areas that are well managed and maintained. The Element also promotes efficient use of water and other natural resources and strives to ensure the long-term sustainability of non-renewable resources. The Element also supports the preservation and creation of parks, recreational facilities, and open spaces.

Energy production, transportation, and consumption are key contributors to greenhouse gases affecting climate change, poor local air quality, and a variety of other sustainability challenges. The Conservation and Open Space Element encourages and supports land use development patterns and transportation choices that reduce pollutants and greenhouse gases. In addition, the Element encourages renewable energy production, along with efficient energy use in buildings and infrastructure and minimizes the impacts of projects that can generate air pollutants.

The Conservation and Open Space Element also sets forth goals and policies that minimize agricultural land use conflicts and support the long-term presence and viability of the County's agricultural industry.

Relationship to Other General Plan Elements

The effectiveness of the Conservation and Open Space Element depends upon its integration with the other elements comprising this General Plan. Elements that share topics, issues, and policy direction with the Conservation and Open Space Element include Land Use, Mobility, Housing, Noise, and Safety.

Primary objectives of the Land Use Element are to minimize future development in areas with significant natural resources that are identified in the Conservation and Open Space Element; along with areas that may be affected by natural hazards that are identified in both the Conservation and Open Space and Safety Elements. In addition, the Land Use Element encourages the development of vibrant and healthy communities, of which park and recreation facilities are an integral part. The Land Use Element also balances the availability of water with future development, while the Conservation and Open Space Element establishes policies that protect and conserve water resources to ensure they are available for future supplies. The Land Use and Mobility Elements also include goals and policies that address Climate Change by fostering land use patterns that facilitate a reduction in vehicle miles traveled and by planning for



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

transportation networks that encourage other modes of travel rather than the single-occupant motor vehicle.

The purpose of the Safety Element is to establish policies related to future development that will minimize the risk of personal injury, loss of life, property damage, and environmental damage associated with natural hazards, as identified in both the Conservation and Open Space and Safety Elements. The Safety Element identifies floodplain locations throughout the County, while Figure C-2 (Floodwater Accommodation) identifies the rivers, creeks, streams, flood corridors, riparian habitats, and land that may accommodate floodwater for purposes of groundwater recharge and stormwater management. The Mobility Element includes regional trails and bikeways, which are major recreational assets for the region.

This Element also has connections to the Housing and Noise Elements. Regarding the Housing Element, the goals and policies contained in this Element affect where and how housing is planned and developed, such as requiring development to avoid sensitive resources. With regard to noise issues, biological resources can be adversely affected by noise. Additionally, the mining of mineral resources typically has noise, traffic, air, and groundwater impacts that must be addressed.

Goals and Policies for Conservation and Open Space Element

Biological Resources

CONTEXT

The San Diego region is recognized as one of the most biologically important areas in the United States, and one of the most biologically diverse areas in the world.¹ The diversity of species found in the San Diego region can be attributed to the wide variety of vegetation and habitats associated with the region's range of micro-climates, topography, soils, and other natural features. Unincorporated lands comprise the largest geographical area in the County with natural features that include lagoons, foothills, mountain ranges, and deserts. Today, the San Diego region supports over 400 sensitive plants and animals, ranging in sensitivity from common to critically endangered. All of this diversity is part of the San Diego region's unique natural heritage and a legacy for future generations.

HABITATS & SPECIES

The physical and climatic conditions found in the San Diego region provide for a wide variety of habitats and biological communities. These communities are associations of plants, animals, fungi, and microbes. Different habitat types may occur separately or be intermixed, but because they have different characteristics, they often support unique assemblages of species.

¹ Dobson, A.P., J.P. Rodriguez, W.M. Roberts, and D.S. Wilcove. 1997 Geographic Distribution of Endangered Species in the United States. *Science* 275(5299): 550-553.

GOALS AND POLICIES

The San Diego region's unique attributes have resulted in a relatively large number of endemic species in the area, that is, species that are only found in a limited geographic location. For example, 26 plant species in the County are found nowhere else in the world². When combined with habitat loss from urban, rural, and agricultural development, the result is that the County is home to an exceptional number of rare, threatened, endangered, or otherwise sensitive species. Both wildfire events and invasive plant and animal species further disrupt native habitat regeneration and pose a threat to conservation of native habitat and endemic species.

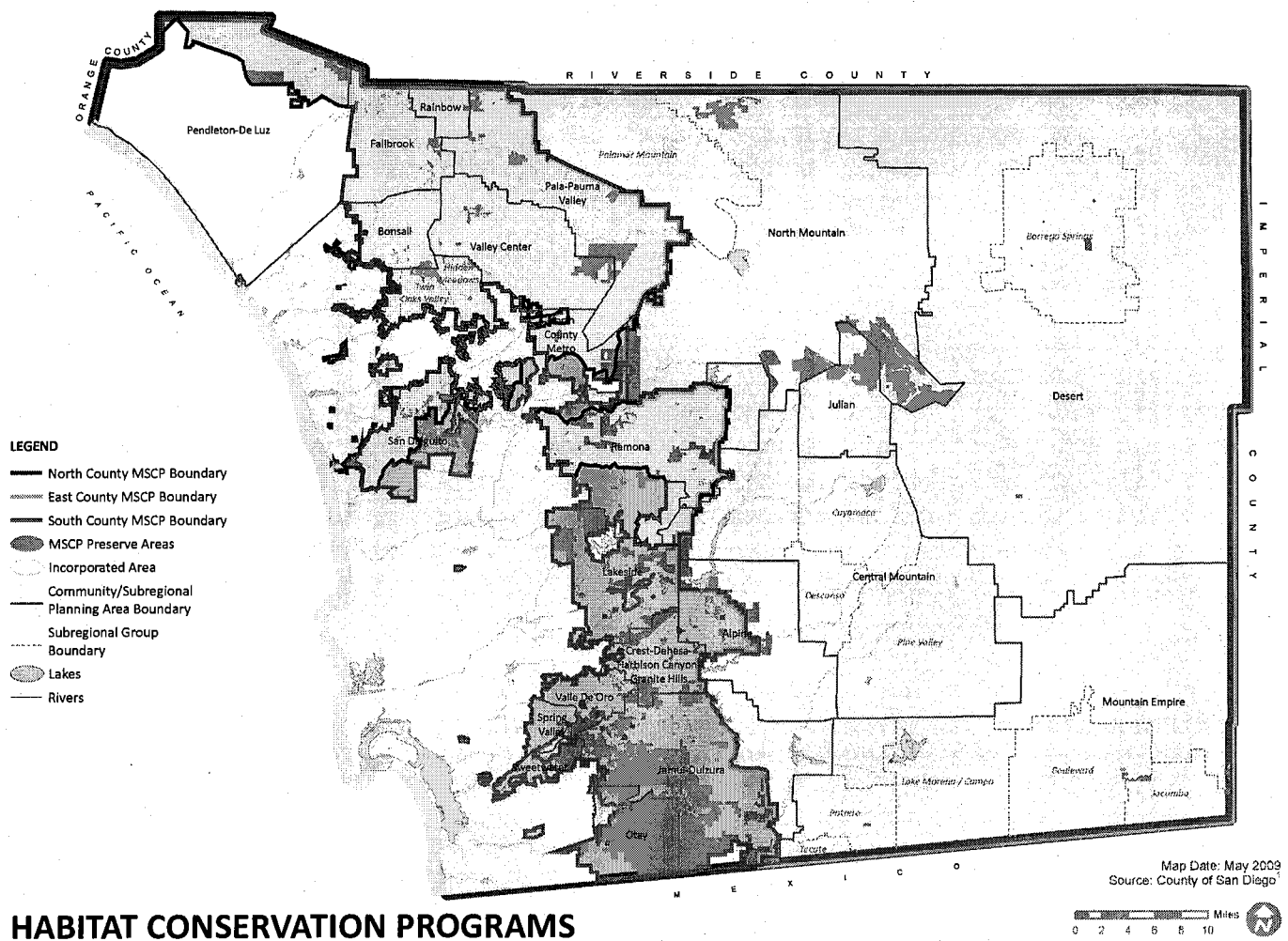
Waterways and their associated riparian vegetation provide important habitat values for wildlife, including several rare species of birds. Moreover, wetlands provide important water quality functions such as pollutant removal, floodwater retention, and greenhouse gas reduction. Valuable wetland resources in the County have been reduced from past development such that they must be protected, along with adjacent upland habitats, to maintain their functions and values.

Protecting the region's resources requires coordination and cooperation with other governmental and non-governmental entities, such as SANDAG, adjacent jurisdictions, California Department of Fish and Game, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, California Regional Water Quality Control Board, California Coastal Commission, and various conservation organizations.

WILDLIFE CORRIDORS AND HABITAT LINKAGES

Significant portions of the County are publicly owned, including areas designated as open space preserves and parks, National Forests, and State Parks. The County strives to work harmoniously with all such entities to achieve common goals. Important wildlife corridors and linkages have been identified to provide connections between areas of undeveloped lands, especially to significant public lands. Species that are well-distributed across their ranges are less susceptible to extinction than species confined to small portions of their range. Therefore, maintaining large, inter-connected blocks of habitat containing sizable and diverse populations of sensitive species is superior to a fragmented landscape with undersized populations. Figure C-1 (Habitat Conservation Programs) identifies existing preserve areas, along with areas where a connected system of preserves will be established as additional easements are recorded for open space and/or lands are acquired for public benefit.

² <http://www.sdnhm.org/research/botany/sdplants/preface.html>



HABITAT CONSERVATION PROGRAMS

San Diego County General Plan

Figure C-1

GOALS AND POLICIES

Wildlife corridors and linkages function better when they support sufficient native habitat conducive for wildlife movement. Linkages are landscape level, regional connections between core habitat areas. They consist of a variety of upland and riparian habitat types which provide resources for year-around foraging, nesting, and local dispersal. Corridors are more local movement paths for species that typically follow naturally occurring paths.

The San Diego region is an important part of the Pacific Flyway, one of the major migration routes for birds between Alaska and Central and South America. Some migrant birds use parts of the County as winter habitat



Escondido Creek serves as a wildlife corridor in the San Dieguito Community Planning Area

or as stopover sites for resting and feeding. Stopover sites are just as critical to bird conservation as breeding habitat. Many spring migrants coming north from the Gulf of California or along the west coast of mainland Mexico use the San Diego region, with its comparatively low mountains, as a corridor for crossing the mountains to reach the Pacific coast.

Local migration of birds and other wildlife is also important. For example, in the San Diego region, western bluebirds breed in the mountains but migrate to the coastal lowlands and other warmer regions for the winter. Many of the larger mammals in the County, such as mountain lions, mule deer, and bobcats, move between blocks of habitat as part of their daily routine searching for food, water, and shelter. Inter-connected habitats are also important to prevent isolation of populations of plants and animals.

GOALS AND POLICIES

GOAL COS-1

Inter-Connected Preserve System. A regionally managed, inter-connected preserve system that embodies the regional biological diversity of San Diego County.

Policies

COS-1.1 Coordinated Preserve System. Identify and develop a coordinated biological preserve system that includes Pre-Approved Mitigation Areas, Biological Resource Core Areas, wildlife corridors, and linkages to allow wildlife to travel throughout their habitat ranges.

COS-1.2 Minimize Impacts. Prohibit private development within established preserves. Minimize impacts within established preserves when the construction of public infrastructure is unavoidable.

COS-1.3 Management. Monitor, manage, and maintain the regional preserve system facilitating the survival of native species and the preservation of healthy populations of rare, threatened, or endangered species.



Gnatcatcher



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

- COS-1.4 Collaboration with Other Jurisdictions.** Collaborate with other jurisdictions and trustee agencies to achieve well-defined common resource preservation and management goals.
- COS-1.5 Regional Funding.** Collaborate with other jurisdictions and federal, state, and local agencies to identify regional, long-term funding mechanisms that achieve common resource management goals.
- COS-1.6 Assemblage of Preserve Systems.** Support the proactive assemblage of biological preserve systems to protect biological resources and to facilitate development through mitigation banking opportunities.
- COS-1.7 Preserve System Funding.** Provide adequate funding for assemblage, management, maintenance, and monitoring through coordination with other jurisdictions and agencies.
- COS-1.8 Multiple-Resource Preservation Areas.** Support the acquisition of large tracts of land that have multiple resource preservation benefits, such as biology, hydrology, cultural, aesthetics, and community character. Establish funding mechanisms to serve as an alternative when mitigation requirements would not result in the acquisition of large tracts of land.
- COS-1.9 Invasive Species.** Require new development adjacent to biological preserves to use non-invasive plants in landscaping. Encourage the removal of invasive plants within preserves.
- COS-1.10 Public Involvement.** Ensure an open, transparent, and inclusive decision-making process by involving the public throughout the course of planning and implementation of habitat conservation plans and resource management plans.
- COS-1.11 Volunteer Preserve Monitor.** Encourage the formation of volunteer preserve managers that are incorporated into each community planning group to supplement professional enforcement staff.

GOAL COS-2

Sustainability of the Natural Environment. Sustainable ecosystems with long-term viability to maintain natural processes, sensitive lands, and sensitive as well as common species, coupled with sustainable growth and development.

Policies

- COS-2.1 Protection, Restoration and Enhancement.** Protect and enhance natural wildlife habitat outside of preserves as development occurs according to the underlying land use designation. Limit the degradation of regionally important natural habitats within the Semi-Rural and Rural Lands regional categories, as well as within Village lands where appropriate.
- The preservation of existing native plants and the planting of a variety of native (genetically locally adapted) or compatible non-native, non-invasive plant species enhance wildlife habitat areas.*
- COS-2.2 Habitat Protection through Site Design.** Require development to be sited in the least biologically sensitive areas and minimize the loss of natural habitat through site design.

GOAL COS-3

Protection and Enhancement of Wetlands. Wetlands that are restored and enhanced and protected from adverse impacts.

GOALS AND POLICIES

Policies

COS-3.1 Wetland Protection. Require development to preserve existing natural wetland areas and associated transitional riparian and upland buffers and retain opportunities for enhancement.

COS-3.2 Minimize Impacts of Development. Require development projects to:

- Mitigate any unavoidable losses of wetlands, including its habitat functions and values; and
- Protect wetlands, including vernal pools, from a variety of discharges and activities, such as dredging or adding fill material, exposure to pollutants such as nutrients, hydromodification, land and vegetation clearing, and the introduction of invasive species.

Water Resources

CONTEXT

The County relies upon a safe and reliable supply of this most basic necessity for its quality of life and economic prosperity. Not only do the County's clean water resources provide drinking water, but they also sustain the County's rich natural environment. Water resources may be classified as surface water, which collects in streams, rivers, lakes, reservoirs and groundwater, which resides in subsurface aquifers.

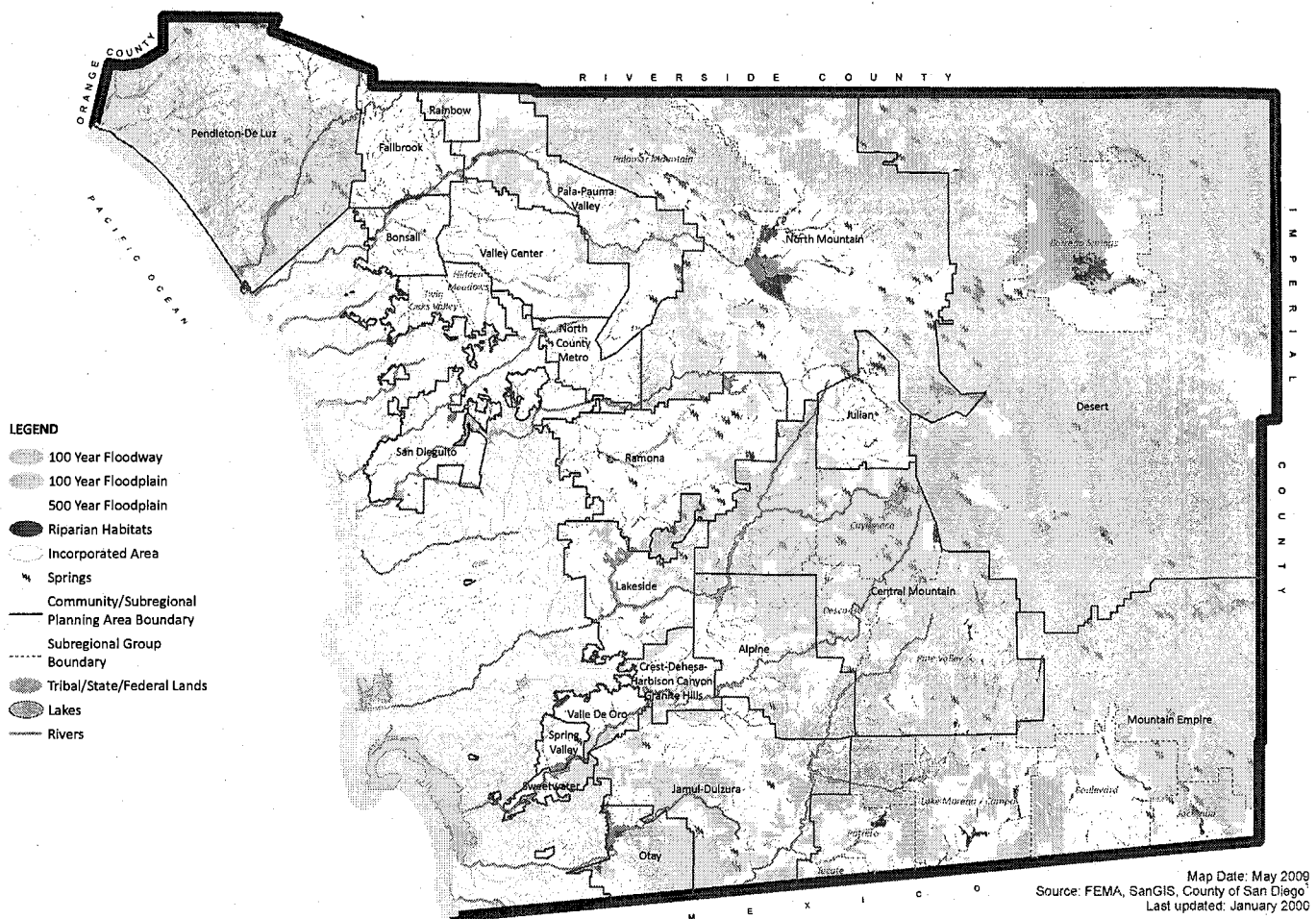
While surface water can drain through the County's watersheds, it can also be infiltrated into the subsurface saturated zone to become groundwater, a resource that many residents of the unincorporated County depend upon. Aquifers are recharged at varying rates depending upon a number of factors, primarily the amount and frequency of rainfall. On average, the County's coastal areas see less than ten inches of rain per year, the mountain peaks in excess of 40 inches, and the deserts less than three inches. Not only must the County have sufficient quantities of groundwater, but the water must also be of a sufficient quality. Figure C-2 (Floodwater Accommodation) identifies the rivers, creeks, streams, flood corridors, riparian habitats, and land that may accommodate floodwater for purposes of groundwater recharge and stormwater management.

Watersheds facilitate the collection and transportation of sediments and pollutants that can degrade water quality and damage downstream environments. Lakes and reservoirs capture flows from many of these watersheds. Watershed management relates to sustaining watersheds at an acceptable level of quality, contributing to resource surface and subsurface quality, and maintaining groundwater supplies.

The County of San Diego is divided into two hydrologic regions—the Colorado Hydrologic Region (CHR) which drains in an easterly direction into the Salton Sea and the San Diego Hydrologic Region (SDHR) which drains in a westerly direction toward the Pacific Ocean and encompasses most of the County, parts of southwestern Riverside County and southwestern Orange County. The watersheds, areas into which surface run-off, streams, creeks, and rivers drain, in the County of San Diego are shown on Figure C-3 (Watersheds).



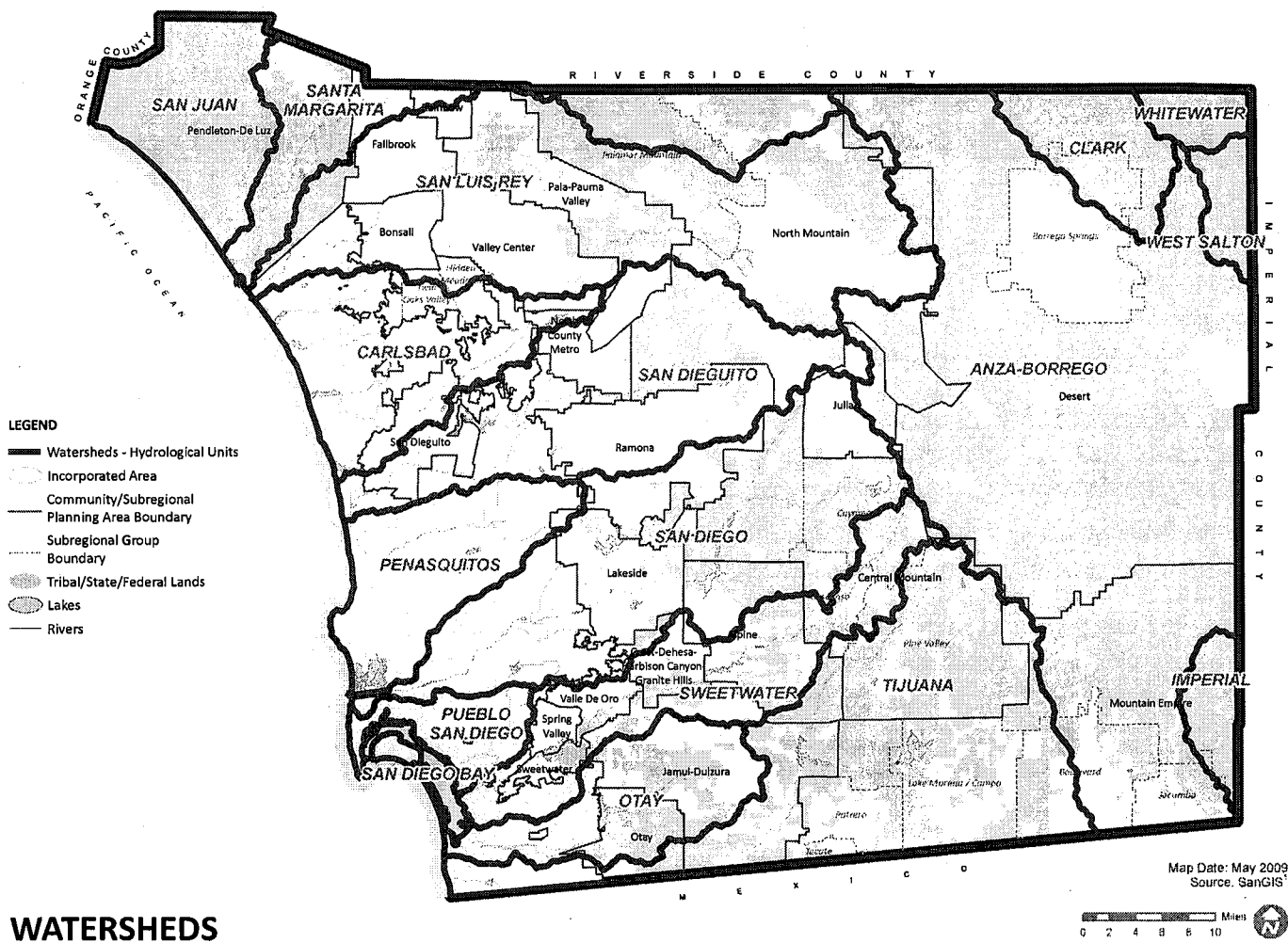
Lake Jennings



FLOODWATER ACCOMMODATION

San Diego County General Plan

Figure C-2



WATERSHEDS

San Diego County General Plan

Figure C-3



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

Groundwater aquifers and local surface water reservoirs are of great importance to providing an adequate water supply for communities that are not served by imported water. It is critical to protect the water quality found in the local drinking water reservoirs and aquifers to ensure a continual source of drinking water, as well as increasing local supplies through recycling and conservation efforts. Imported supplies also help to replenish local groundwater basins. The City of San Diego has seven water reservoirs in the unincorporated County that are crucial to protecting habitat. These reservoirs include Barrett, El Capitan, Hodges, Morena, Otay, San Vicente, and Sutherland.

The Metropolitan Water District of Southern California imports water from the Colorado River and Northern California. This water is distributed to water purveyors in San Diego County. The Metropolitan Water District (MWD) sets the targets for lowering demands and securing the necessary supplies in the Integrated Resources Plan (IRP). The so-called "Preferred Resource Mix" is identified based on extensive technical modeling, IRP workgroups, and stakeholder involvement. The 2004 MWD IRP assumed that new local efforts—both increasing supplies and lowering demands—would meet the needs of population growth. Given the challenges facing imported supplies, it is widely expected that the 2009 IRP will have an even greater focus on control of demand through recycling and conservation efforts. (For additional information on water supply and how agencies are planning to meet future demands, refer to the Land Use Element, Community Services and Infrastructure section.)

GOALS AND POLICIES

GOAL COS-4

Water Management. A balanced and regionally integrated water management approach to achieve the long-term viability of the County's water quality and supply.

COS-4.1 Water Conservation. Require development to reduce the waste of potable water through use of efficient technologies and conservation efforts that minimize the County's dependence on imported water and conserve groundwater resources.

COS-4.2 Drought-Efficient Landscaping. Require efficient irrigation systems and in new development encourage the use of native plant species and non-invasive drought tolerant/low water use plants in landscaping.

COS-4.3 Stormwater Filtration. Maximize stormwater filtration and/or infiltration in areas that are not subject to high groundwater by maximizing the natural drainage patterns and the retention of natural vegetation and other pervious surfaces. This policy shall not apply in areas with high groundwater, where raising the water table could cause septic system failures, moisture damage to building slabs, and/or other problems.

COS-4.4 Groundwater Contamination. Require land uses with a high potential to contaminate groundwater to take appropriate measures to protect water supply sources.

Potential sources of groundwater contamination include, but are not limited to, landfills, fertilizer, pesticide, manure storage and sales, petroleum product storage tanks, manufacturing plants, and on-site wastewater treatment systems.

COS-4.5 Recycled Water. Promote the use of recycled water and gray water systems where feasible.

GOALS AND POLICIES

GOAL COS-5

Protection and Maintenance of Water Resources. Protection and maintenance of local reservoirs, watersheds, aquifer-recharge areas, and natural drainage systems to maintain high-quality water resources.

Water conservation is also addressed in Goal COS-19 in the "Air Quality, Climate Change, and Energy" section below.

Policies

COS-5.1 Impact to Floodways and Floodplains. Restrict development in floodways and floodplains in accordance with policies in the Flood Hazards section of the Safety Element.

Development in floodways and floodplains has the potential to alter natural hydrologic flow and cause soil erosion and increased stormwater runoff—including loss of wetland and health issues related to surface and groundwater contamination.

COS-5.2 Impervious Surfaces. Require development to minimize the use of directly connected impervious surfaces and to retain stormwater run-off caused from the development footprint at or near the site of generation. *Impervious surface area impairs groundwater recharge and contributes to stormwater runoff and heat retention.*

COS-5.3 Downslope Protection. Require development to be appropriately sited and to incorporate measures to retain natural flow regimes, thereby protecting downslope areas from erosion, capturing runoff to adequately allow for filtration and/or infiltration, and protecting downstream biological resources.

COS-5.4 Invasive Species. Encourage the removal of invasive species to restore natural drainage systems, habitats, and natural hydrologic regimes of watercourses.

COS-5.5 Impacts of Development to Water Quality. Require development projects to avoid impacts to the water quality in local reservoirs, groundwater resources, and recharge areas, watersheds, and other local water sources.

Protecting reservoir water quality requires that the quality of the water entering the reservoirs is maintained or improved. Pollutants of high concern are nutrients and related algae, total organic carbon, and total dissolved solids.



Agricultural Resources

CONTEXT

The County of San Diego is the only major urban county with a farm gate value³ consistently ranked among the top ten agricultural counties (ranked eight for several years) in California.⁴ The County has the fourth highest number of farms of any county in the country and third highest number of farms of any county in California.⁵ Agriculture is the fifth largest component of the County's economy.⁶ Agriculture in the County provides an array of economic, environmental, and social benefits that contribute to the quality of life in the region. Agriculture also provides a valuable open space resource and plays a critical role in regional wildlife conservation by providing usable open space corridors and habitat for some species.



Agricultural uses in Julian

The County of San Diego is the only major urban county with a farm gate value⁷ consistently ranked among the top ten agricultural counties (ranked eight for several years) in California.⁸ The County has the fourth highest number of farms of any county in the country and third highest number of farms of any county in California.⁹ Agriculture is the fifth largest component of the County's economy.¹⁰ Agriculture in the County provides an array of economic, environmental, and social benefits that contribute to the quality of life in the region. Agriculture also provides a valuable open space resource and plays a critical role in regional wildlife conservation by providing usable open space corridors and habitat for some species.

The resources that support the County's agriculture are unique. Unlike other jurisdictions across the nation, farming in San Diego is dependent upon the region's unusual microclimates and often has very little

³ The farm gate value of a cultivated product in agriculture or aquaculture is the net value of the product when it leaves the farm, after marketing costs have been subtracted. Since many farms do not have significant marketing costs, it is often understood as the price of the product at which it is sold by the farm (the farm gate price). The farm gate value is typically lower than the retail price consumers pay in a store as it does not include costs for shipping, handling, storage, marketing and profit margins of the involved companies.

⁴ Source: USDA National Agricultural Statistics Service, Summary of California County Agricultural Commissioners' Reports, 2004-2005.

⁵ Source: USDA National Agricultural Statistics Service, Census of Agriculture, 2002.

⁶ Source: San Diego Regional Chamber of Commerce, 2006.

⁷ The farm gate value of a cultivated product in agriculture or aquaculture is the net value of the product when it leaves the farm, after marketing costs have been subtracted. Since many farms do not have significant marketing costs, it is often understood as the price of the product at which it is sold by the farm (the farm gate price). The farm gate value is typically lower than the retail price consumers pay in a store as it does not include costs for shipping, handling, storage, marketing and profit margins of the involved companies.

⁸ Source: USDA National Agricultural Statistics Service, Summary of California County Agricultural Commissioners' Reports, 2004-2005.

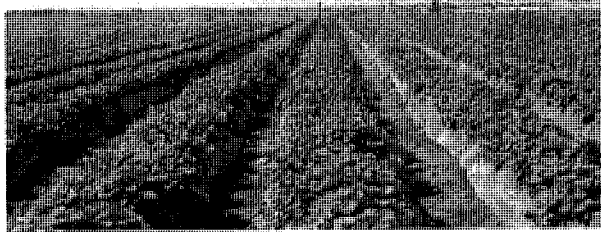
⁹ Source: USDA National Agricultural Statistics Service, Census of Agriculture, 2002.

¹⁰ Source: San Diego Regional Chamber of Commerce, 2006.

GOALS AND POLICIES

relationship to the quality of the soils. Much of the County's climate supports a year-round growing season that facilitates successful small farms and crop diversification producing over 200 agricultural commodities including high value specialty crops, nursery products, and a variety of fruits. Only six percent of the San Diego region's soils are classified as prime agricultural soils. The small percentage of prime soils, the small farm size, and the high value of agriculture in the region highlights the uniqueness of farming in the County.

A number of issues create pressures and stresses for the ongoing success of agriculture. These include conflicts associated with the urban/agricultural interface, land use pressures, water quality issues, and the



Agriculture is the fifth largest industry in San Diego County

high economic cost of operation. In addition, agricultural resources are particularly important in riverbeds, but face conflicts with aggregate resource extraction and wildlife corridor protection. These, among other issues, have increased the economic and social pressures faced by San Diego's farmers and represent a challenge to the future success of the County's agricultural industry.

GOALS AND POLICIES

GOAL COS-6

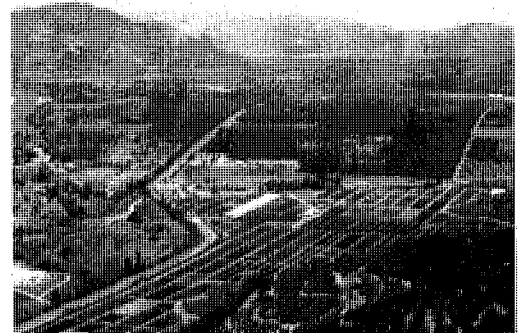
Sustainable Agricultural Industry. A viable and long-term agricultural industry and sustainable agricultural land uses in the County of San Diego that serve as a beneficial resource and contributor to the County's rural character and open space network.

Policies

COS-6.1 Economic Diversity. Support the economic competitiveness of agriculture and encourage the diversification of potential sources of farm income, including value added products, agricultural tourism, roadside stands, organic farming, and farmers markets.

COS-6.2 Protection of Agricultural Operations. Protect existing agricultural operations from encroachment of incompatible land uses by doing the following:

- Limiting the ability of new development to take actions to limit existing agricultural uses by informing and educating new projects as to the potential impacts from agricultural operations
- Encouraging new or expanded agricultural land uses to provide a buffer of non-intensive agriculture or other appropriate uses (e.g., landscape screening) between intensive uses and adjacent non-agricultural land uses



The agriculturally rich Pala-Pauma Valley



Agriculture in semi-rural area near Ramona



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

- Allowing for agricultural uses in agricultural areas and designing development and lots in a manner that facilitates continued agricultural use within the development.
- Requiring development to minimize potential conflicts with adjacent agricultural operations through the incorporation of adequate buffers, setbacks, and project design measures to protect surrounding agriculture
- Supporting local and State right-to-farm regulations
- Retain or facilitate large and contiguous agricultural operations by consolidation of development during the subdivision process

Discourage development that is potentially incompatible with intensive agricultural uses includes schools and civic buildings where the public gather, daycare facilities under private institutional use, private institutional uses (e.g., private hospitals or rest homes), residential densities higher than two dwelling units per acre, and offices and retail commercial.

- COS-6.3 Compatibility with Recreation and Open Space.** Encourage siting recreational and open space uses and multi-use trails that are compatible with agriculture adjacent to the agricultural lands when planning for development adjacent to agricultural land uses.

Recreational and open space uses can serve as an effective buffer between agriculture and development that is potentially incompatible with agriculture uses.

- COS-6.4 Conservation Easements.** Support the acquisition or voluntary dedication of agriculture conservation easements and programs that preserve agricultural lands.

In addition to their economic value, agricultural lands provide the added benefit of serving as habitat areas for sensitive animal species.

- COS-6.5 Best Management Practices.** Encourage best management practices in agriculture and animal operations to protect watersheds, reduce GHG emissions, conserve energy and water, and utilize alternative energy sources, including wind and solar power.

Cultural Resources

CONTEXT

Our cultural past has helped shape our present community and will continue to create our future. Archaeological and historic resources, known collectively as cultural resources, are the tangible or intangible remains left by ancestral people who made and used them. Cultural resources, found throughout the County of San Diego, are irreplaceable reminders of the County's prehistoric and historic past that continues to have value for communities today. These resources can provide clues to prehistoric and historic human behaviors, and provide scientific, religious, and other valuable educational information about our cultural past. In addition, these resources such as



One of the historical sites listed on the San Diego County Historic Property Listing, the Somers-Linden Farmhouse was constructed between 1891 and 1892.

GOALS AND POLICIES

sacred places and traditional cultural properties continue to influence and have value for the County's living tribal people. The cultural environment encompasses both the built (post-1769) and the archaeological environments, which include both prehistoric and historic archaeological sites. Cultural resources are found throughout the County and include not only physical evidence of the past such as Native American rock shelters, and pictographs but the intangible evidence such as traditional cultural lands and sacred sites. Examples of historic cultural resources (the built environment) include homes, barns, bridges, fountains, and silos. In 2008, the County of San Diego had more than 23,000 recorded cultural resource sites and this number continues to grow.

GOALS AND POLICIES

GOAL COS-7

Protection and Preservation of Archaeological Resources. Protection and preservation of the County's important archeological resources for their cultural importance to local communities, as well as their research and educational potential.

Policies

COS-7.1 Archaeological Protection. Preserve important archaeological resources from loss or destruction and require development to include appropriate mitigation to protect the quality and integrity of these resources.

The importance of archaeological resources must be evaluated from the perspective of the affected community, including local tribes, in addition to the definitions contained in the California Public Resources Code. Input from the affected community on the importance of cultural resources through the consultation process is important in determining what resources should be preserved and what constitutes appropriate mitigation.

COS-7.2 Open Space Easements. Require development to avoid archeological resources whenever possible. If complete avoidance is not possible, require development to fully mitigate impacts to archaeological resources.

Avoidance of archaeological resources is normally achieved through the design of the development project in conjunction with the use of open space easements that protect the resources. If complete avoidance is not possible, other forms of mitigation, including data recovery excavations and the incorporation of archaeological features into the project design on a case-by-case basis may be appropriate. The determination of what constitutes adequate mitigation should be based on meaningful consultation with the affected community, including local tribes.

COS-7.3 Archaeological Collections. Require the appropriate treatment and preservation of archaeological collections in a culturally appropriate manner

The determination of what constitutes appropriate treatment and preservation of archaeological collections should be based on existing federal curation standards in combination with consultation with the affected community, such as the tribes. Many collections should be placed in a local collections curation facility that meets federal standards per 36 CFR Part 79. The proper storage and treatment of these collections should also be based on consultation with the affected community, such as the tribes. In addition, existing federal and state law governs the treatment of certain cultural items and human remains, requires consultation, and in some circumstances, repatriation. The County is committed to conduct an inventory of collections it holds or are held by cultural resources consulting firms.



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

- COS-7.4 Consultation with Affected Communities.** Require consultation with affected communities, including local tribes to determine the appropriate treatment of cultural resources.

Consultation should take place with the affected communities concerning the appropriate treatment of cultural resources, including archaeological sites, sacred places, traditional cultural properties, historical buildings and objects, artifacts, human remains, and other items. The County is required by law, Senate Bill 18 Protection of Traditional Tribal Cultural Places (SB-18), to consult with the appropriate tribes for projects that may result in major land use decisions including General Plans, General Plan Amendments, Specific Plans and Specific Plan Amendment. In addition to these types of permits, it is County policy to consult with the appropriate tribes on all other projects that contain or are likely to contain, archaeological resources. Consultation may also include active participation by the tribes as monitors in the survey, testing, excavation, and grading phases of the project.

- COS-7.5 Treatment of Human Remains.** Require human remains be treated with the utmost dignity and respect and that the disposition and handling of human remains will be done in consultation with the Most Likely Descendant (MLD) and under the requirements of Federal, State and County Regulations.

Human remains, including ancestral Native American remains, should be left undisturbed and preserved in place whenever possible. For most development permits, this is required by the County's Resource Protection Ordinance. In the event that human remains are discovered during any phase of an archaeological investigation, the requirements of State and local laws and ordinances, including notification of and consultation with appropriate tribal members, must be followed in determining what constitutes appropriate treatment of those remains.

- COS-7.6 Cultural Resource Data Management.** Coordinate with public agencies, tribes, and institutions in order to build and maintain a central database that includes a notation whether collections from each site are being curated, and if so, where, along with the nature and location of cultural resources throughout the County of San Diego.

This database should be accessible to all qualified individuals while maintaining the confidentiality of the location and nature of sensitive cultural resources, such as archaeological sites. The County maintains a partnership with the local repository of the database, the South Coastal Information Center at San Diego State University, which provides direct access by qualified County personnel to the database so that the information it contains may be used to design development projects to avoid cultural resources at an early point in the process.

GOAL COS-8

Protection and Conservation of the Historical Built Environment. Protection, conservation, use, and enjoyment of the County's important historic resources.

Policies

- COS-8.1 Preservation and Adaptive Reuse.** Encourage the preservation and/or adaptive reuse of historic sites, structures, and landscapes as a means of protecting important historic resources as part of the discretionary application process, and encourage the preservation of historic structures identified during the ministerial application process.

GOALS AND POLICIES

Historic buildings, objects, trails, landscapes and districts are important parts of the multi-cultural heritage of San Diego County and should be preserved for the future enjoyment and education of the County's diverse populations. Preservation and adaptive reuse of these resources should be encouraged during the planning process and an emphasis should be placed on incentives for preservation, such as the Mills Act property tax program, in addition to restrictions on development, where appropriate.



Alpine Women's Club is located in the former Alpine Hall built in 1899

COS-8.2 Education and Interpretation. Encourage and promote the development of educational and interpretive programs that focus on the rich multicultural heritage of the County of San Diego.

The County should continue to develop educational and interpretive programs that focus on the history of San Diego County, including but not limited to the important historical resources located on County parks, such as the Adobe at Rancho Penasquitos and Rancho Guajome. Such programs should be for residents and visitors of all ages from all communities and should include docent and self-guided tours, interpretive signage, kiosks, informational pamphlets, books and other audio-visual materials.

Paleontological Resources and Unique Geological Features

CONTEXT

PALEONTOLOGICAL RESOURCES

Paleontological resources are the fossilized remains and/or traces of prehistoric life—both plant and animal—as well as sedimentary formations in which they occur and the locations where they may be collected. Fossils are generally older than 10,000 years, a temporal boundary marking the end of the glacial Pleistocene Epoch and the beginning of the warmer Holocene Epoch in which we live today. For planning purposes, paleontological resources exclude human remains, which are considered cultural resources.

In the San Diego region, fossils typically occur in undisturbed sedimentary rock layers beneath the soil and sometimes may be found in surface outcrops. These fossils are limited and non-renewable. They are considered unique and worthy of preservation when they contain a unique or unusual assemblage of fossil organisms, provide paleo-biological information, provide insight to prehistoric life, or are the best example of its kind in the region.

The County can be divided into three distinct geomorphic regions—the Coastal Plain, the Peninsular Ranges, and the Salton Trough (the desert). Each region is characterized by different climatic, topographic, biological, and geologic settings. Correspondingly, each region contains geologic deposits that are associated with particular types of fossils, some of which are unique within the context of California and even the United States. Since fossils form in sedimentary rocks, most of the fossils in the San Diego region are in the Coastal Plain and Salton Trough strata. In the plutonic Peninsular Ranges, fossils occur only in valleys and other environments where material eroded from the mountains was transported down hill and deposited.



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

UNIQUE GEOLOGICAL RESOURCES

The San Diego region has a rich geologic history. Unique geological features are those that are locally or regionally unique in the context of the geologic history of California. They may include particular rocks or strata that explain or result from geologic processes that have affected the County and that lend themselves to scientific study.

The present landforms that characterize the San Diego region are the result of a series of geologic events spanning millions of years. These events include intrusive emplacement of magma, regional volcanism, large-scale erosion, river- and ocean-derived sedimentation, local faulting and uplift, and hydrothermal processes. The scale of some of the resulting unique geologic features, such as entire rock formations, can be much larger than the scale of other natural resources in the County. The conservation/preservation of these large-scale features is not necessarily needed or desired, as long as examples of them remain represented in the County. The County defines a "unique geologic feature" as a site that exhibits distinctive characteristics, is exclusive to the region, or provides a key piece of geologic information important in the study of geology or geologic history. Examples may include unique rock outcrops (e.g., natural bridge), type localities of named geologic formations (e.g., type locality of Scripps Formation in the sea cliffs north of Scripps Institute of Oceanography), information-rich geologic exposures (e.g., cliff face exposing faulted sedimentary layers), or unique landform (e.g., Round Mountain in Jacumba Valley, which represents a volcanic plug).

GOALS AND POLICIES

GOAL COS-9

Educational and Scientific Uses. Paleontological resources and unique geologic features conserved for educational and/or scientific purposes.

Policies

COS-9.1 Preservation. Require the salvage and preservation of unique paleontological resources when exposed to the elements during excavation or grading activities or other development processes.

COS-9.2 Impacts of Development. Require development to minimize impacts to unique geological features from human related destruction, damage, or loss.

Mineral Resources

CONTEXT

Mineral resources are vital to community development and economic prosperity and also support recreational, educational, and scientific pursuits. The County's supply of accessible mineral resources is finite and exhaustible. Management of the remaining mineral deposits is important to ensure adequate resources are available to support the economic prosperity of future generations of County citizens.

GOALS AND POLICIES

MINERAL RESOURCES OF SAN DIEGO COUNTY

The State Geologist has classified certain areas of the County as underlain by significant mineral deposits. These areas are identified as Mineral Resource Zone 2 (MRZ-2) on the maps prepared by the California Geological Survey (Figure C-4 [Mineral Resource Zones]). Some of these areas have also been designated by the State Mining and Geology Board as containing mineral resources of “statewide or regional significance.”

The term “mineral resource” refers to a concentration or occurrence of a naturally occurring material in such form or amount that economic extraction of a commodity is currently potentially feasible. In San Diego County, there are three general categories of important mineral resources, including construction materials, industrial and chemical mineral materials, and metallic and rare materials. Although mineral resources of all types are economically important, the continued availability of construction aggregate for the development of roads, homes, buildings, and other infrastructure is essential to the economy of the County. While the County is underlain by vast quantities of mineral deposits from which aggregate can be produced, urban development has encroached upon many existing and potential future mining sites. This development and other non-compatible land uses has reduced or eliminated access to many of the local important mineral deposits.

Two mineral classification reports have been completed for San Diego County; these include (1) Mineral Land Classification: Aggregate Materials in the Western San Diego County Production-Consumption Region¹¹ and (2) Update of Mineral Land Classification: Aggregate Materials in the Western San Diego County Production-Consumption Region.¹² The latter 1996 report concluded that aggregate reserves significantly decreased since the 1982 study and that Portland cement concrete (PCC)-grade aggregate reserves within Western San Diego County were enough to supply the demand for 20 years (until 2016). The report further concluded it was unlikely all identified resources would be mined as access to resources could be substantially restricted by competing conservation measures, such as the MSCP program.

As a result, few new mining sites have been recently permitted in the County and the aggregate production rate from existing local mining sites has not kept pace with demand. The total permitted aggregate resources as of January 2006 were 198 million tons, a 28 percent decrease from January 2001.¹³ The permitted aggregate resources represent only 17 percent of the 50-year estimated demand (year 2006 to 2056) of 1,164 million tons. To meet demand, substantial volumes of aggregate are being imported from quarries located outside of San Diego County. Due to increased transportation costs, the price for aggregate in the County is among the highest in the State of California. The total permitted area of local mining facilities contains less than a 50-year supply of aggregate for the County. Thus, maintaining access to mineral resources, especially the remaining undeveloped MRZ-2 classified lands, is important for the future economic activity of the County.

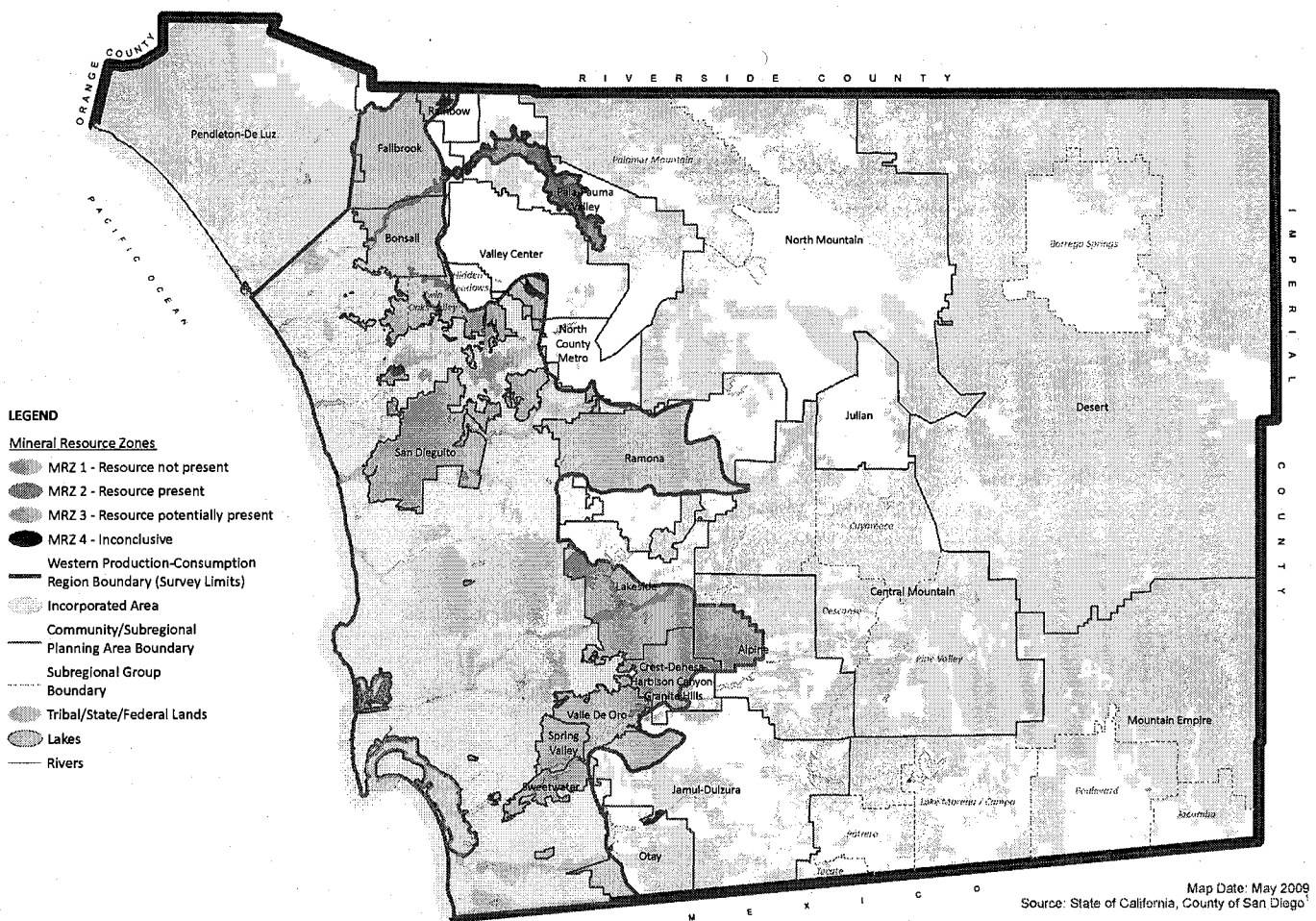
PERMITTING AND RECLAMATION OF MINING SITES

In order for a new mining site to be operated, the California *Surface Mining and Reclamation Act* (SMARA) requires that a permit is granted by the local lead agency (the County), and a Reclamation Plan prepared

¹¹ Kohler, S.L. & Miller, R.V. (1982). California Department of Conservation, Special Report 153

¹² Davis, James F. (1996). California Department of Conservation, DMG Open-File Report 96-04

¹³ California Geological Survey (2006), Map Sheet 52 – Aggregate Availability in California



MINERAL RESOURCE ZONES

San Diego County General Plan

Figure C-4

GOALS AND POLICIES

consistent with the minimum standards for reclamation listed in Article 9, Section 3700 et seq. of the State Mining and Geology Board reclamation regulations. The Reclamation Plan is subject to approval by the County in coordination with the California Department of Conservation.

RECYCLING OF CONSTRUCTION MATERIALS

Although not a mining activity, the recycling of construction materials collected from demolished buildings, roadways, or other facilities can incrementally increase the local availability (i.e. production rate) of construction materials and extend the lifespan of existing mining operations. (Recycling also extends the lifespan of local landfills.)

GOALS AND POLICIES

The goals and policies listed below are intended to achieve the following:

- Assure an adequate supply of mineral resources to support the economic activity projected to occur under the County General Plan.
- Comply with the requirements of the SMARA with regard to the conservation of mineral resources, and the permitting and reclamation of mining sites.

GOAL COS-10

Protection of Mineral Resources. The long-term production of mineral materials adequate to meet the local County average annual demand, while maintaining permitted reserves equivalent to a 50-year supply, using operational techniques and site reclamation methods consistent with SMARA standards such that adverse effects on surrounding land uses, public health, and the environment are minimized.

Policies

COS-10.1 Siting of Development. Encourage the conservation (i.e., protection from incompatible land uses) of areas designated as having substantial potential for mineral extraction. Discourage development that would substantially preclude the future development of mining facilities in these areas. Design development or uses to minimize the potential conflict with existing or potential future mining facilities. For purposes of this policy, incompatible land uses are defined by SMARA Section 3675.

COS-10.2 Protection of State-Classified or Designated Lands. Discourage development or the establishment of other incompatible land uses on or adjacent to areas classified or designated by the State of California as having important mineral resources (MRZ-2), as well as potential mineral lands identified by other government agencies. The potential for the extraction of substantial mineral resources from lands classified by the State of California as areas that contain mineral resources (MRZ-3) shall be considered by the County in making land use decisions.

COS-10.3 Road Access. Prohibit development from restricting road access to existing mining facilities, areas classified MRZ-2 or MRZ-3 by the State Geologist, or areas identified in the County Zoning Ordinance for potential extractive use in accordance with SMARA section 2764.a.



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

- COS-10.4 Compatible Land Uses.** Discourage the development of land uses that are not compatible with the retention of mining or recreational access to non-aggregate mineral deposits. *See Policy COS-10.1 for a definition of incompatible land uses.*
- COS-10.5 Reclamation Plans.** Require all mining projects to be conducted in accordance with a reclamation plan that meets the minimum reclamation standards required by the California *Surface Mining and Reclamation Act* and the associated State Mining and Geology Board regulations. Require the reclamation plan to include a phasing plan that provides for the completion of the surface mining on each segment of the mined lands so that the reclamation can be initiated at the earliest possible time on those portions of the mined lands that will not be subject to further disturbance by the surface mining operation.
- COS-10.6 Conservation of Construction Aggregate.** Encourage the continued operation of existing mining facilities and streamline the permitting of new mining facilities consistent with the goal to establish permitted aggregate resources that are sufficient to satisfy 50 years of County demand.
- COS-10.7 Recycling of Debris.** Encourage the installation and operation of construction and demolition (C&D) debris recycling facilities as an accessory use at permitted (or otherwise authorized) mining facilities to increase the supply of available mineral resources.
- COS-10.8 New Mining Facilities.** Develop specific permit types and procedures for the authorization of new mining facilities that recognize the inherent physical effects of mining operations and the public necessity for available mineral resources adequate to meet local demand, in accordance with PRC Section 2762.
- COS-10.9 Overlay Zones.** Provide zoning overlays for MRZ-2 designated lands and a 1,500-foot-wide buffer area adjacent to such lands. Within these overlay zones, the potential effects of proposed land use actions on potential future extraction of mineral resources shall be considered by the decision-makers.

Visual Resources

CONTEXT

Visual resources are diverse in nature. They are found both within the natural environment and the built, or human-made, environment. Visual resources can be valued both objectively and subjectively based on their quality, uniqueness, prominence, relationship to community identity, and economic contributions, such as to land values and tourism. Visual resources are important from an aesthetic perspective when, based on the characteristics summarized above; they are identified as containing significant scenic value.

While existing visual resources can be preserved or enhanced, the urban growth anticipated by this General Plan provides opportunities to identify or even create new visual resources, both within existing communities and in new growth areas. Goals and policies in this section emphasize the protection of scenic corridors and dark skies within the natural environment and the recognition and enhancement of community character within the built environment.

GOALS AND POLICIES

LANDSCAPE/SETTING

The landscape of the San Diego region is rich in natural open space, unique topographic resources, and scenic vistas. These natural features contribute greatly to the overall quality of the existing visual setting experienced by viewers within the County. Urban land uses are focused in the western third of the County, while the eastern two-thirds are largely undeveloped with mountains and desert dominating the landscape. The County of San Diego has three distinctive geographic regions, listed from west to east:

- Low-lying Coastal Plain
- Mountainous Peninsular Range
- Desert Salton (Imperial) Basin

The diversity of these regions provides San Diego County residents and visitors with an array of natural vistas and scenic environments that provide a unique aesthetic collection from the ocean to the desert.

Throughout these three distinctive geographic provinces are vast amounts of publicly owned lands that provide open space and visual relief from the human-made environment. Examples include the Marine Corps Base Camp Pendleton on the Coastal Plain in northern San Diego County; the Cleveland National Forest in the Peninsular Range; and Anza-Borrego Desert State Park in the Salton (Imperial) Basin. In addition to these examples of large expanses of open space, County parks, habitat preserves, reservoirs, and undeveloped lands contribute to the County's open space lands and overall aesthetic resource value.

Aesthetic value is not limited to open space and rural lands, but also can be demonstrated through architectural design, or in historic structures and districts, streetscapes, and manufactured landscapes. Within the "developed" environment, scenic features can include built uses such as structures of historic significance or architectural merit, open but developed areas such as expansive agricultural fields or groves, and the individual form and character of a unique neighborhood or community. These valuable aesthetic elements of the human-made environment can be found throughout the County. A well-known example is the historic gold-mining community of Julian.

SCENIC CORRIDORS

A highway corridor generally includes the land adjacent to and visible from the vehicular right-of-way. The dimension of the corridor is usually identified using a motorist's line of vision and may include viewshed, extending to the horizon. A "scenic highway" can pertain to any freeway, highway, road, or other vehicular right-of-way along a corridor with considerable natural or otherwise scenic landscape.

State Scenic Highways are those highways that are either officially designated by Caltrans or are eligible for designation. This statewide system of scenic highways is part of the Master Plan of State Highways Eligible for Official State Designation as Scenic Highways. A highway may be designated as "scenic" depending upon how much of the natural landscape can be seen by travelers, the aesthetic quality of the landscape, and the extent to which development intrudes upon the traveler's enjoyment of the view.

A highway's status changes from "eligible" to "officially designated" when the local jurisdiction adopts a scenic corridor protection program, applies to Caltrans for scenic highway approval, and receives notification from Caltrans that the highway has been designated as an official State Scenic Highway. Two County routes have been designated State Scenic Highways; these include (1) State Route 78 through the Anza-Borrego



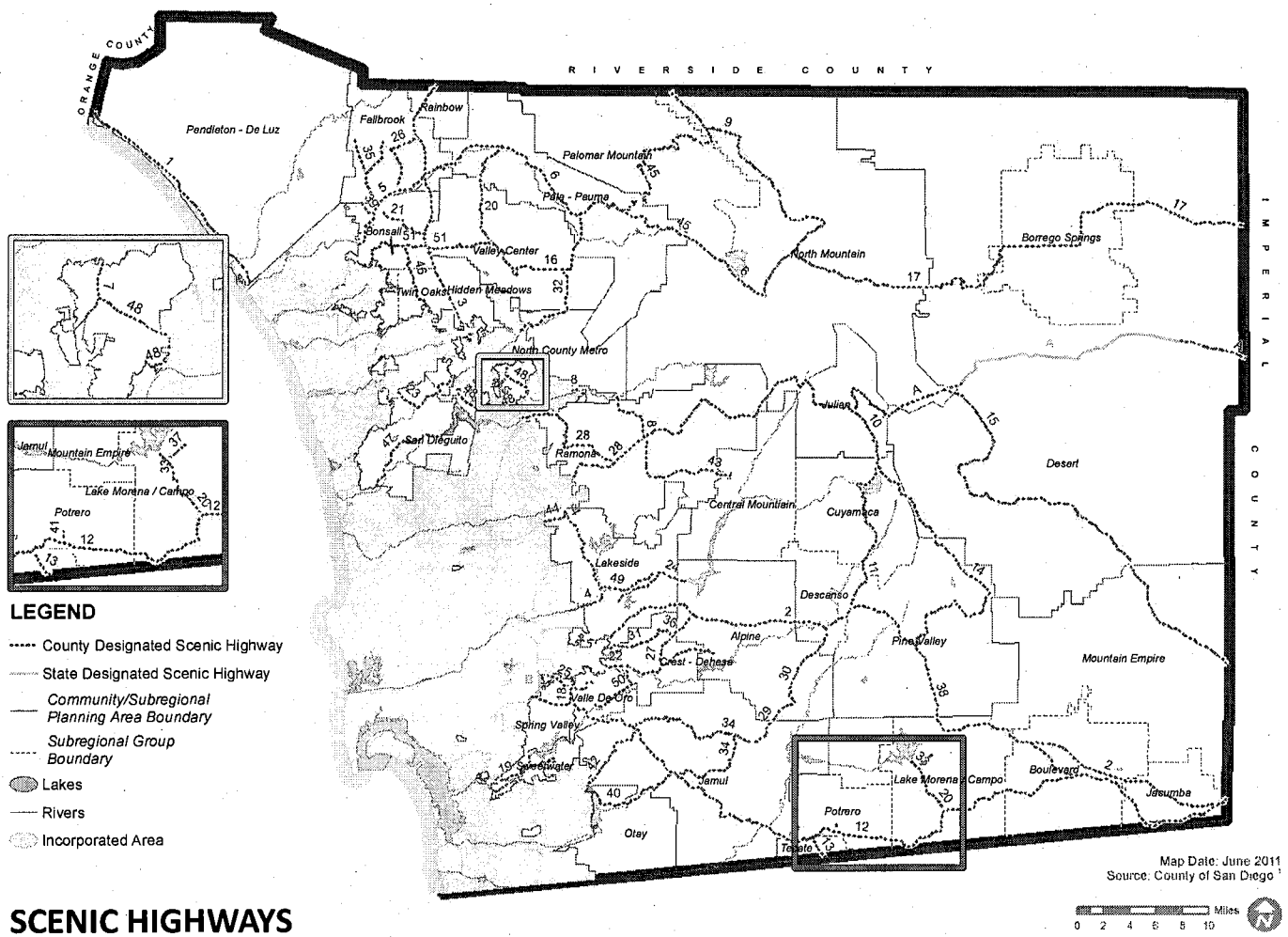
CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

Desert State Park (18.2-mile segment) and (2) State Route 125 from State Route 94 in Spring Valley to Interstate 8 in La Mesa (two miles of this segment are in the unincorporated County). In addition, Sunrise Highway (S1) is a National Scenic Byway that runs north from Old Highway 80 to State Route 79 through the Cleveland National Forest. Roads within the unincorporated County included in the Scenic Highway system are shown on Figure C-5 (Scenic Highways) and in Table COS-1 (County Scenic Highway System).

Table COS-1 County Scenic Highway System		
Map Ref.	Route	Segment
A	State Route 78	Wynola Road east to Imperial County line (excluding portion in Anza-Borrego Desert State Park)
B	State Route 125	State Route 94 to Interstate 8
1	Interstate 5	Oceanside city limits north to Orange County line
2	Interstate 8	El Cajon city limits to Imperial County line
3	Interstate 15	Escondido city limits north to Riverside County line
4	State Route 67	Santee city limits to State Route 78 (excluding portion in city of Poway)
5	State Route 76	Oceanside city limits east to Interstate 15
6	State Route 76	Interstate 15 east to State Route 79
7	Bear Valley Parkway and State Route 78	Escondido city limits southeast to Via Rancho Parkway
8	State Route 78	Via Rancho Parkway to State Route 79 (excluding portion within city of San Diego)
9	State Route 79	Riverside County line to State Route 76
10	State Route 79	State Route 78 (Wynona) south to Old Highway 80
11	State Route 79	Interstate 8 north to Sunrise Highway
12	State Route 94	State Route 125 to Interstate 8
13	State Route 188 (Tecate Road)	U.S. / Mexican Border north to State Route 94
14	Sunrise Highway (S1)	State Route 79 south to Old Highway 80
15	Old Overland Stage Route (S2)	Imperial County line north to State Route 78
16	Lilac Road and Valley Center Road (S6)	State Route 76 to State Route 76
17	San Felipe Road, Montezuma Valley Road, Pal Canyon Road, Peg Leg Road, and Borrego Salton Seaway (S22)	State Route 79 east to Imperial County line
18	Avocado Boulevard	State Route 94 to El Cajon city limits
19	Bonita, San Miguel, Guajolote, and Sweetwater River Roads	Interstate 805 north to State Route 94 (excluding portion within city of Chula Vista)
20	Buckman Springs Road	Lake Morena Drive to State Route 94
21	Camino del Rey west to Lilac Road	Oceanside city limits east to Vista Way
22	Dehesa Road	El Cajon city limits to Tavern Road
23	Elfin Forest Road / Harmony Grove Road	San Marcos city limits to Escondido city limits
24	El Monte Road	El Capitan Reservoir to Lake Jennings Park Road

GOALS AND POLICIES

Table COS-1 County Scenic Highway System		
Map Ref.	Route	Segment
25	Fuerte Drive	Interstate 8 to Chase Ave.
26	Gird, Reche, Live Oak Park, and Mission Roads	State Route 76 north and east to Interstate 15
27	Harbison Canyon Road	Arnold Way to Dehesa Road
28	Highland Valley Road	San Diego city limits to State Route 67
29	Honey Springs Road	State Route 94 north to Lyons Valley Road
30	Japatul Road	Lyons Valley Road to Interstate 8
31	La Cresta Road	Greenfield Drive to La Cresta Boulevard
32	Lake Wohlford Road	Valley Center Road east (Escondido city limits) to Valley Center Road (excluding portion within city of Escondido)
33	Lake Morena Drive	Buckman Springs Road north to Morena Lake
34	Lyons Valley Road	State Route 94 to Cleveland National Forest
35	Mission and Green Canyon Roads	State Route 76 north and east to Reche Road
36	Mountain View Road/Francis Drive	La Cresta Boulevard to Harbison Canyon Road
37	Oak Drive	Lake Morena Drive north to Buckman Springs Road
38	Old Highway 80	State Route 79 (Pine Valley) to Interstate 8 (Jacumba)
39	Olive Hill Road	State Route 76 to planning area boundary
40	Otay Lakes Road	Chula Vista city limits to State Route 94
41	Potrero Valley Road	State Route 94 to Potrero County Park
42	Proctor Valley Road	Chula Vista city limits to State Route 94
43	San Vicente and Ramona Oaks Roads	State Route 78 to Cleveland National Forest
44	Scripps Poway Parkway	Poway city limits to State Route 67
45	South Grade Road, Canfield Rd/Highway to the Stars, Palomar Divide Road, and Oak Grove Truck Trail	State Route 76 to State Route 78
46	Twin Oaks Valley Road	Gopher Canyon Road to San Marcos city limits
47	Via de la Valle, Paseo Delicias, and Del Dios Highway	San Diego city limits east to Via Rancho Parkway
48	Via Rancho Parkway (San Pasqual Road)	Del Dios Highway to State Route 78 (excluding portions in cities of Escondido and San Diego)
49	Willow and El Monte Roads	State Route 67 to southern end of El Capitan Reservoir
50	Willow Glen Drive	Jamacha Road to Dehesa Road
51	Vista Way, Gopher Canyon, and Old Castle Roads	Vista city limits north and east to Lilac Road



SCENIC HIGHWAYS

San Diego County General Plan

Figure C-5

GOALS AND POLICIES

ASTRONOMICAL DARK SKIES

Astronomical research has contributed to a greater understanding of our solar system, supported advances in space travel, improved telecommunication systems, advanced weather forecasting, and provided insight to energy production. The maintenance of dark skies in San Diego County is vital to the two world-class observatories that depend on them for astronomical research. The five criteria for a high-quality site include: (1) Elevation over 5,000 feet above sea level; (2) clear, cloud-free night sky; (3) proximity to the Pacific Ocean; (4) distance from urban areas; and (5) freedom from nearby sources of light, dust, and smoke. Sites in the United States that meet these criteria are found only in west Texas, central New Mexico, Arizona, the central California coast, and the San Diego region.

The two sites in the County of San Diego, which meet all of the above criteria, include Palomar and Mount Laguna Observatories. The maintenance of dark skies in the County is vital to their operation and the astronomical research carried out at these facilities. Palomar Observatory, located 5,500 feet at the top of Palomar Mountain in northern San Diego County near Palomar Mountain State Park, is privately owned and operated by the California Institute of Technology (Caltech) and is used to support some of California's and the United States' premier scientific research programs. San Diego State University (SDSU) and the University of Illinois operate the Mount Laguna Observatory jointly. Located at an altitude of 6,100 feet on the eastern edge of the Cleveland National Forest near the Anza-Borrego State Park, 45 miles east of downtown San Diego, the Mount Laguna Observatory is one of the County's best astronomical research and education facilities.

GOALS AND POLICIES

GOAL COS-11

Preservation of Scenic Resources. Preservation of scenic resources, including vistas of important natural and unique features, where visual impacts of development are minimized.

Policies

COS-11.1 Protection of Scenic Resources. Require the protection of scenic highways, corridors, regionally significant scenic vistas, and natural features, including prominent ridgelines, dominant landforms, reservoirs, and scenic landscapes.

COS-11.2 Scenic Resource Connections. Promote the connection of regionally significant natural features, designated historic landmarks, and points of regional historic, visual, and cultural interest via designated scenic corridors, such as scenic highways and regional trails.

COS-11.3 Development Siting and Design. Require development within visually sensitive areas to minimize visual impacts and to preserve unique or special visual features, particularly in rural areas, through the following:

- Creative site planning
- Integration of natural features into the project
- Appropriate scale, materials, and design to complement the surrounding natural landscape
- Minimal disturbance of topography

Potential measures for promoting scenic compatibility may include limiting or avoiding soundwalls, placing utilities underground, minimizing grading, and providing scenic vista points.



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

- Clustering of development so as to preserve a balance of open space vistas, natural features, and community character.
- Creation of contiguous open space networks

COS-11.4 Collaboration with Agencies and Jurisdictions. Coordinate with adjacent federal and State agencies, local jurisdictions, and tribal governments to protect scenic resources and corridors that extend beyond the County's land use authority, but are important to the welfare of County residents.

COS-11.5 Collaboration with Private and Public Agencies. Coordinate with the California Public Utilities Commission, power companies, and other public agencies to avoid siting energy generation, transmission facilities, and other public improvements in locations that impact visually sensitive areas, whenever feasible. Require the design of public improvements within visually sensitive areas to blend into the landscape.

COS-11.6 Billboards. Prohibit new billboards and other forms of large-scale advertising and signage within scenic corridors. Encourage the removal of existing billboards and other forms of large-scale advertising and signage along State and County scenic highway corridors.

COS-11.7 Underground Utilities. Require new development to place utilities underground and encourage "undergrounding" in existing development to maintain viewsheds, reduce hazards associated with hanging lines and utility poles, and to keep pace with current and future technologies.

The concept of "undergrounding" in the initial phases of a project not only increases the aesthetic value of the surrounding viewshed, but can also reduce costs in the long run since less infrastructure is exposed to the elements.

GOAL COS-12

Preservation of Ridgelines and Hillsides. Ridgelines and steep hillsides that are preserved for their character and scenic value.

Policies

COS-12.1 Hillside and Ridgeline Development Density. Protect undeveloped ridgelines and steep hillsides by maintaining semi-rural or rural designations on these areas.

COS-12.2 Development Location on Ridges. Require development to preserve the physical features by being located down and away from ridgelines so that structures are not silhouetted against the sky.

GOAL COS-13

Dark Skies. Preserved dark skies that contribute to rural character and are necessary for the local observatories.

Policies

COS-13.1 Restrict Light and Glare. Restrict outdoor light and glare from development projects in Semi-Rural and Rural Lands and designated rural communities to retain the quality of night skies by minimizing light pollution.

GOALS AND POLICIES

COS-13.2 Palomar and Mount Laguna. Minimize, to the maximum extent feasible, the impact of development on the dark skies surrounding Palomar and Mount Laguna observatories to maintain dark skies which are vital to these two world-class observatories by restricting exterior light sources within the impact areas of the observatories.

COS-13.3 Collaboration to Retain Night Skies. Coordinate with adjacent federal and State agencies, local jurisdictions, and tribal governments to retain the quality of night skies by minimizing light pollution.

Air Quality, Climate Change, and Energy

CONTEXT

There is a strong correlation between land use planning, transportation system planning, and the emission of air quality pollutants, greenhouse gases (GHG) that contribute to global climate change (GCC) and criteria pollutants that degrade air quality within a region. The primary opportunities to reduce air quality pollutants and GHG emissions are in the urbanized areas of the County where there are land use patterns that can best support the increased use of transit and pedestrian activities since most GHGs and air pollutants result from mobile source emissions. The unincorporated County can also be a part of the solution by producing development patterns that contribute to reducing the dependence on the automobile and by promoting development with lower energy demands.

The development of sustainable communities contributes to both the reduction in overall air pollutants as well as solving the larger challenges associated with GCC. A holistic approach to achieving sustainable communities requires the integration of a regionwide multi-modal transportation system with a significant reduction in the reliance on single-occupant motor vehicles, along with buildings that consume less through design and efficient building materials.

AIR QUALITY

The boundaries of the San Diego Air Basin are contiguous with the political boundaries of San Diego County, including the incorporated cities, and encompass approximately 4,260 square miles. The County is divided by the Laguna Mountain Range with peaks that exceed 6,000 feet, which runs approximately parallel to the coast about 45 miles inland and separates the coastal area from the desert. To the north of the County are the Santa Ana Mountains which run along the Orange County coast, turning east to join with the Laguna Mountains near the San Diego-Orange County border.

Air pollutant emission sources in the San Diego Air Basin are typically grouped into two categories: stationary and mobile sources. Mobile source emissions can be attributed to vehicles and transportation related activities. Stationary sources can be further divided into two major subcategories: point and area sources. Point source emissions originate from manufacturing and industrial processes. Area source emissions are generated from residential heaters, small engines, and other consumer products. They are widely distributed and may have a cumulative effect.

According to readings from the ten monitoring stations operated by San Diego APCD, the County has experienced substantial improvement in ambient ozone levels. The number of days above the Federal one-



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

hour ozone standard has decreased from 39 days in 1990 to zero days in 2005, while the number of days above the more stringent State standard has decreased from 139 days in 1990 to 16 days in 2005. However, in 2004, the County of San Diego was designated a basic non-attainment area for the new eight-hour ozone standard.

Transportation is California's largest source of carbon dioxide, with passenger vehicles and light duty trucks creating more than 46 percent of total climate change emissions.¹⁴ Toxic air contaminants (TAC) include pollutants known or suspected to cause cancer or other adverse health effects such as respiratory irritation or reproductive effects. The regulatory structure for TAC is different than for criteria pollutants. In San Diego County, motor vehicles and natural sources are key contributors of TAC, emitting more than 27 million pounds; while industrial, commercial, and government facilities emit more than three million pounds of TAC. Since 1989, emissions from industrial and commercial sources reduced by approximately 75 percent. Prioritizing and reducing these emissions further will require a continued, cooperative effort by the public, industry, environmental groups, the California Air Resources Board (ARB), and the California Air Pollution Control District (APCD).

CLIMATE CHANGE

The natural "greenhouse effect" allows the earth to remain warm and sustain life. GHGs trap the sun's heat in the atmosphere, like a blanket, and help determine our climate. The amount of GHGs in the atmosphere is being drastically altered by human activity. The onset of the industrial revolution and the increased consumption of fossil fuels (wood, coal, gasoline, etc.) have substantially increased atmospheric levels of GHGs. Temperatures rise as atmospheric concentrations of GHGs (such as carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons) increase. Over time, this rise in temperatures results in climate change. GHGs have been at the center of the widely contested political, economic, and scientific debate surrounding GCC.

State legislation *California Global Warming Solutions Act of 2006* requires that the State's global warming emissions be reduced to 1990 levels by year 2020. Through more efficient land use patterns, promoting a variety of modes of transportation, and encouraging new and existing development to implement a variety of energy efficient, energy conserving and renewable technologies and practices, the County is supporting the legislation and providing the mechanism for reduced emissions throughout the region.

Human activities produce GHGs. For example, burning fossil fuels such as oil, coal, and natural gas for energy to power automobiles, homes, and factories put carbon dioxide into the air. While carbon dioxide is the GHG emitted in the largest quantity, other GHGs such as methane, nitrous oxide, and fluorocarbons also contribute to the problem. In California, carbon dioxide accounts for approximately 84 percent of all the GHGs, while methane makes up approximately eight percent, and nitrous oxide and hydrofluorocarbons contribute an additional six percent and two percent, respectively.

The principal sources of carbon dioxide in the atmosphere are fossil fuel combustion and wildland fires. Agriculture is a major source of both methane and nitrous oxide, with additional methane coming primarily from landfills. Cars also emit methane and nitrous oxide. In California, more than half of fossil fuel emissions of carbon dioxide are related in some way to transportation. Fossil fuels account for 98 percent of carbon dioxide emissions, with a two percent contribution from several industrial processes that produce carbon

¹⁴ University of San Diego, September 2008

GOALS AND POLICIES

dioxide as a by-product.¹⁵ Buildings contribute to 40 percent of GHGs worldwide, though this is likely to be less in the County due to the rural characteristics of many areas.

Countywide, over a million tons of organic materials are disposed of in landfills annually, with approximately 200,000 tons disposed from the unincorporated County. Currently operating and closed landfills are significant sources of GHG emissions. An estimated 50 million cubic feet of methane and carbon dioxide are released daily from both closed and active County landfills, but other more potentially impactful greenhouse emissions are also released such as volatile organic carbon gases. Emissions result from the decomposition of organic materials in the anaerobic condition present in landfills.

Although methane recovery systems are placed on closed landfills, the majority of the methane generated by anaerobic decomposition occurs either prior to the recovery system's placement or is not captured by this system. Sequestering carbon through composting stabilizes the carbon in the soil materials, resulting in a very slow release of carbon dioxide and effectively prevents the formation of methane, which is 24 times more retentive of atmospheric heat than carbon dioxide. Capturing methane by anaerobic digestion of agricultural manures and burning the gas for the production of electricity on the farm is also very effective in reducing methane emissions.

ENERGY & SUSTAINABLE DEVELOPMENT

San Diego Gas & Electric (SDG&E) is a regulated public utility that provides electric service to 3.4 million customers within a 4,100-square-mile service area that encompasses 25 cities throughout San Diego and southern Orange Counties. In 2003, the three key energy agencies in California—the California Energy Commission (CEC), the California Power Authority (CPA), and the California Public Utilities Commission (CPUC)—came together to adopt an Energy Action Plan that identifies joint goals for California's energy future and sets forth a commitment to achieve these goals through specific actions. In 2008, an Energy Action Plan Status Update was released to incorporate the CEC's 2007 Integrated Energy Policy Report (IEPR), reflecting the passage of Assembly Bill 32, the California Global Warming Act of 2006. The IEPR includes advanced policies, intended to enable California to meet its energy needs in a carbon-constrained world. The report also provides a comprehensive set of recommended actions to achieve these policies. SDG&E's Long Term Resource Plan (LTRP) sets forth a strategy of mixed resources to ensure long-term, reliable, and affordable power in the region, as established by the CPUC. The CPUC regulates energy issues related to supply, delivery, rates, and tariffs for all SDG&E customers in the County.

Population is the primary driver of increasing demand for new housing. From the 1980s to the 1990s, the rate of growth of population diminished, however, electricity consumption grew by 29 percent, and natural gas consumption grew by 36 percent. In 2001, with the electricity crisis, there was a significant drop in per capita consumption of energy. SANDAG has projected that the population of the San Diego region will grow 38 percent by 2030, resulting in nearly four million people. Therefore, the demand for energy will also rise as this new population seeks ways to cool/heat and light their homes and power their cars.

¹⁵ AB 1493 (Pavley) Briefing Package prepared by the California Environmental Protection Agency at <http://www.climatechange.ca.gov/background/index.html>



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

Energy and water are inextricably linked, especially in Southern California, where moving imported water around the State requires large amounts of energy. For example, the California State Water Project uses more energy than any single user. Therefore, reducing water use can save significant amounts of energy.

Energy efficiency, a key to meeting long-term energy needs, implies using less energy to perform the same function. Conserving energy or “doing without”, and using energy more efficiently by doing the same task with less energy, are methods where the County can promote to extend the supply of energy, with minimal to no adverse impacts. Installing lighting that uses less electricity, installing additional insulation to reduce heating and cooling requirements, and switching to a vehicle with better gas mileage are energy efficiency measures. Conservation connotes “doing without” in order to save energy rather than using less energy to do the same thing. For example, turning off lights, turning down the air conditioner, and making fewer vehicle trips are all conservation measures.

Renewable sources include everything from small rooftop solar photovoltaic applications to larger renewable developments such as the Kumeyaay Wind project. While the large projects can supply energy to many thousands of homes, they generally require new transmission lines, which can result in land use and aesthetic impacts, along with an increased risk of wildfires. San Diego County depends on fossil fuels and natural gas to generate a large portion of its energy and power. These resources are non-renewable, and can be polluting. It is likely that non-renewable resources will become a more scarce and costly method of producing energy in the future. Other sources of energy can be derived from technologies such as methane recovery at landfills, roof-top solar panels and solar farms, wind turbines, bio-fuels, and rarer projects such as those that harness geothermal or tidal energy. These technologies are renewable, and can supplement existing non-renewable sources, extending the supply of non-renewable fuels and offering an alternative to polluting energy sources.

GOALS AND POLICIES

GOAL COS-14

Sustainable Land Development. Land use development techniques and patterns that reduce emissions of criteria pollutants and GHGs through minimized transportation and energy demands, while protecting public health and contributing to a more sustainable environment. [See also Goal LU-6]

Policies

COS-14.1 Land Use Development Form. Require that development be located and designed to reduce vehicular trips (and associated air pollution) by utilizing compact regional and community-level development patterns while maintaining community character.

COS-14.2 Villages and Rural Villages. Incorporate a mixture of uses within Villages and Rural Villages that encourage people to walk, bicycle, or use public transit to reduce air pollution and GHG emissions.

COS-14.3 Sustainable Development. Require design of residential subdivisions and nonresidential development through “green” and sustainable land development practices to conserve energy, water, open space, and natural resources.

GOALS AND POLICIES

- COS-14.4 Sustainable Technology and Projects.** Require technologies and projects that contribute to the conservation of resources in a sustainable manner, that are compatible with community character, and that increase the self-sufficiency of individual communities, residents, and businesses.
- COS-14.5 Building Siting and Orientation in Subdivisions.** Require that buildings be located and oriented in new subdivisions and multi-structure non-residential projects to maximize passive solar heating during cool seasons, minimize heat gains during hot periods, enhance natural ventilation, and promote the effective use of daylight.
- COS-14.6 Solar Access for Infill Development.** Require that property setbacks and building massing of new construction located within existing developed areas maintain an envelope that maximizes solar access to the extent feasible.
- COS-14.7 Alternative Energy Sources for Development Projects.** Encourage development projects that use energy recovery, photovoltaic, and wind energy .
- COS-14.8 Minimize Air Pollution.** Minimize land use conflicts that expose people to significant amounts of air pollutants.
- COS-14.9 Significant Producers of Air Pollutants.** Require projects that generate potentially significant levels of air pollutants and/or GHGs such as quarries, landfill operations, or large land development projects to incorporate renewable energy, and the best available control technologies and practices into the project design.
- The recovered methane from landfills can be pumped through turbines to generate power. This provides a mutual benefit by generating energy and reducing the amount of CO2 and methane being released from landfills. Other uses for closed facilities include photovoltaic (solar) panels, wind, and microturbines, as appropriate for the area they would be located in.*
- COS-14.10 Low-Emission Construction Vehicles and Equipment.** Require County contractors and encourage other developers to use low-emission construction vehicles and equipment to improve air quality and reduce GHG emissions.
- COS-14.11 Native Vegetation.** Require development to minimize the vegetation management of native vegetation while ensuring sufficient clearing is provided for fire control.
- Plants use photosynthesis to remove carbon from the atmosphere by incorporating it into biomass and releasing oxygen into the atmosphere.*
- COS-14.12 Heat Island Effect.** Require that development be located and designed to minimize the “heat island” effect as appropriate to the location and density of development, incorporating such elements as cool roofs, cool pavements, and strategically placed shade trees.
- Heat islands formed as urbanized areas replace natural land cover with pavement, buildings, and other infrastructure, resulting in significantly higher average temperatures than the rural areas surrounding them.*
- COS-14.13 Incentives for Sustainable and Low GHG Development.** Provide incentives such as expedited project review and entitlement processing for developers that maximize use of sustainable and low GHG land development practices in exceedance of State and local standards.

Additional goals and policies that relate to land use development are contained in the Land Use Element.



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

GOAL COS-15

Sustainable Architecture and Buildings. Building design and construction techniques that reduce emissions of criteria pollutants and GHGs, while protecting public health and contributing to a more sustainable environment.



Solar panels in Alpine

Policies

COS-15.1 Design and Construction of New Buildings. Require that new buildings be designed and constructed in accordance with “green building” programs that incorporate techniques and materials that maximize energy efficiency, incorporate the use of sustainable resources and recycled materials, and reduce emissions of GHGs and toxic air contaminants.

Green building programs include the Leadership in Energy and Environmental Design (LEED) standards set by the U.S. Green Building Council, the Green Point Rated system standards set by Builditgreen.org, or equivalent programs.

COS-15.2 Upgrade of Existing Buildings. Promote and, as appropriate, develop standards for the retrofit of existing buildings to incorporate design elements, heating and cooling, water, energy, and other elements that improve their environmental sustainability and reduce GHG.

COS-15.3 Green Building Programs. Require all new County facilities and the renovation and expansion of existing County buildings to meet identified “green building” programs that demonstrate energy efficiency, energy conservation, and renewable technologies.

COS-15.4 Title 24 Energy Standards. Require development to minimize energy impacts from new buildings in accordance with or exceeding Title 24 energy standards.

COS-15.5 Energy Efficiency Audits. Encourage energy conservation and efficiency in existing development through energy efficiency audits and adoption of energy saving measures resulting from the audits.

Energy-efficiency audits include checking, repairing, and readjusting heating, ventilation, and air conditioning, lighting, water heating equipment, insulation, and weather proofing.

COS-15.6 Design and Construction Methods. Require development design and construction methods to minimize impacts to air quality.

GOAL COS-16

Sustainable Mobility. Transportation and mobility systems that contribute to environmental and human sustainability and minimize GHG and other air pollutant emissions.

GOALS AND POLICIES

Policies

- COS-16.1 Alternative Transportation Modes.** Work with SANDAG and local transportation agencies to expand opportunities for transit use. Support the development of alternative transportation modes, as provided by Mobility Element policies.
- COS-16.2 Single-Occupancy Vehicles.** Support transportation management programs that reduce the use of single-occupancy vehicles.
- COS-16.3 Low-Emissions Vehicles and Equipment.** Require County operations and encourage private development to provide incentives (such as priority parking) for the use of low- and zero-emission vehicles and equipment to improve air quality and reduce GHG emissions. [Refer also to Policy M-9.3 (Preferred Parking) in the Mobility Element.]
- COS-16.4 Alternative Fuel Sources.** Explore the potential of developing alternative fuel stations at maintenance yards and other County facilities for the municipal fleet and general public.
- COS-16.5 Transit-Center Development.** Encourage compact development patterns along major transit routes.

The Mobility Element contains additional goals and policies that relate to alternate modes of travel and Transportation Demand Management.

GOAL COS-17

Sustainable Solid Waste Management. Perform solid waste management in a manner that protects natural resources from pollutants while providing sufficient, long term capacity through vigorous reduction, reuse, recycling, and composting programs.

Policies

- COS-17.1 Reduction of Solid Waste Materials.** Reduce greenhouse gas emissions and future landfill capacity needs through reduction, reuse, or recycling of all types of solid waste that is generated. Divert solid waste from landfills in compliance with State law.
- COS-17.2 Construction and Demolition Waste.** Require recycling, reduction and reuse of construction and demolition debris.
- COS-17.3 Landfill Waste Management.** Require landfills to use waste management and disposal techniques and practices to meet all applicable environmental standards.
- COS-17.4 Composting.** Encourage composting throughout the County and minimize the amount of organic materials disposed at landfills.
- COS-17.5 Methane Recapture.** Promote efficient methods for methane recapture in landfills and the use of composting facilities and anaerobic digesters and other sustainable strategies to reduce the release of GHG emissions from waste disposal or management sites and to generate additional energy such as electricity.



On the line at the recycling plant



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

COS-17.6 Recycling Containers. Require that all new land development projects include space for recycling containers.

COS-17.7 Material Recovery Program. Improve the County's rate of recycling by expanding solid waste recycling programs for residential and non-residential uses.

COS-17.8 Education. Continue programs to educate industry and the public regarding the need and methods for waste reduction, recycling, and reuse.

GOAL COS-18

Sustainable Energy. Energy systems that reduce consumption of non-renewable resources and reduce GHG and other air pollutant emissions while minimizing impacts to natural resources and communities.

Policies

COS-18.1 Alternate Energy Systems Design. Work with San Diego Gas and Electric and non-utility developers to facilitate the development of alternative energy systems that are located and designed to maintain the character of their setting.

COS-18.2 Energy Generation from Waste. Encourage use of methane sequestration and other sustainable strategies to produce energy and/or reduce GHG emissions from waste disposal or management sites.

COS-18.3 Alternate Energy Systems Impacts. Require alternative energy system operators to properly design and maintain these systems to minimize adverse impacts to the environment.

GOAL COS-19

Sustainable Water Supply. Conservation of limited water supply supporting all uses including urban, rural, commercial, industrial, and agricultural uses.

Policies

COS-19.1 Sustainable Development Practices. Require land development, building design, landscaping, and operational practices that minimize water consumption.

COS-19.2 Recycled Water in New Development. Require the use of recycled water in development wherever feasible. Restrict the use of recycled water when it increases salt loading in reservoirs.

A permit is required from the County Department of Environmental Health for the use of recycled water.¹⁶

GOAL COS-20

Governance and Administration. Reduction of local GHG emissions contributing to climate change that meet or exceed requirements of the *Global Warming Solutions Act of 2006*.

¹⁶ CPC Title 24, Part 5, California Administrative Code, Appendix G

GOALS AND POLICIES

Policies

- COS-20.1 Climate Change Action Plan.** Prepare, maintain, and implement a climate change action plan with a baseline inventory of GHG emissions from all sources; GHG emissions reduction targets and deadlines, and enforceable GHG emissions reduction measures.
- COS-20.2 GHG Monitoring and Implementation.** Establish and maintain a program to monitor GHG emissions attributable to development, transportation, infrastructure, and municipal operations and periodically review the effectiveness of and revise existing programs as necessary to achieve GHG emission reduction objectives.
- COS-20.3 Regional Collaboration.** Coordinate air quality planning efforts with federal and State agencies, SANDAG, and other jurisdictions.
- COS-20.4 Public Education.** Continue to provide materials and programs that educate and provide technical assistance to the public, development professionals, schools, and other parties regarding the importance and approaches for sustainable development and reduction of GHG emissions.

Parks and Recreation

CONTEXT

This section identifies how the County of San Diego intends to meet the public need for parks and recreation opportunities. This section also identifies how the County intends to meet open space needs including building out the inter-connected preserve system (refer to Goal COS-1) and meeting General Plan goals and County strategic initiatives. The Mobility Element addresses the regional trail network, which further enhances and augments public recreational opportunities and experiences throughout the San Diego region. It should be noted that there are a wide range of park and recreation opportunities within the San Diego region provided by cities, state entities, federal entities, special districts, school districts, and private non-profit organizations in addition to those provided by the County:

- **Local Parks**—Local parks range in acreage depending on the uses and community or neighborhood they serve, and may be associated with joint use facilities such as schools. Typically, local parks contain recreation areas such as a community center, athletic fields, or facilities of special interest to the community. Smaller local parks may be located within or near town centers, where they can be used as common recreation and gathering areas by the community.



The Valle de Oro Community Park is located to the south of the City of El Cajon and to the east of the city of La Mesa.

- **Regional Parks**—Regional parks serve County residents and visitors and are often larger than 200 acres, although smaller facilities may be appropriate for specific sites of regional interest. Regional parks include a variety of passive and active recreational uses and may include an interpretive center. Most regional parks contain open space,

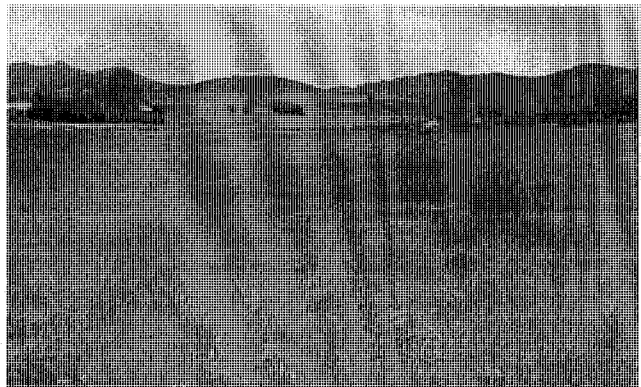


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natural resources, cultural resources, and multi-use trails. Most regional parks also contain a local park element by serving as the recreation outlet for a community.

- **Trails**—Trails provide recreational opportunities and allow for enjoyment by the public of parks and open space preserves. Trails provide connection between recreation uses. The County Trail Program is addressed in detail in the Community Trails Master Plan.
- **Recreation Facilities**—Recreational facilities include community centers, teen centers and gymnasiums and are operated and maintained by County staff, volunteers, and service contracts.
- **Preserves**—Preserves include areas of environmental significance and beauty. The dual purpose of preserves is to protect biological, cultural, and historical resources, as well as community character, and to make these resources available for public recreation opportunities. However, typically only minimal improvements such as trails, parking, and restroom facilities are found in preserves. Some preserves may also provide interpretive or educational amenities. Preserves vary in size depending on the resources being protected, and public access can be limited according to the sensitivity of the resources (*see also Goal COS-1 and related policies in the Biological Resources section*).

Open space in the County is provided by cities, the County, State entities, federal entities, special districts, private non-profit organizations, and land owners as part of the development process. The primary objective of open space within the MSCP preserve system is biological conservation. Open space may also be dedicated / preserved to meet other objectives such as preservation of cultural resources or avoidance of steep slopes. However, open space in general allows for the overall vision of this General Plan, along with the achievement of the County's strategic initiatives, to be met. Other land uses, such as passive recreational opportunities, may be appropriate within open space areas depending on the sensitivity of the resources being protected. In addition to the Park and Recreation goals and policies concerning Open Space, see also goals and policies under the Biological Resources and Cultural Resources sections in this Element.



Grasslands being preserved as open space in Ramona

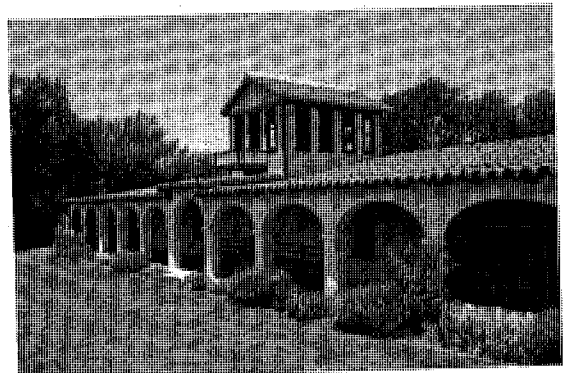
Existing sources of funding for park acquisition and development include federal, state, and local funds, donations, and through developer exactions. The Park Lands Dedication Ordinance (PLDO) provides funding for local park active recreation. The PLDO specifies that new subdivisions are required to dedicate active park land or pay a fee in-lieu of dedication, or a combination of both, at a level of three acres per 1,000 population. State law allows for up to five acres per 1,000 population if the current active park acreage exceeds the three-acre level. These fees may also be used to provide recreational services in regional parks for local community residents. The County also participates in agreements that establish partnerships with other public and private agencies (typically with non-profit organizations) to develop, operate, and maintain recreation facilities on land typically owned by those agencies. Existing sources of funding for open space land acquisition that will ultimately build out the MSCP preserve include local, state and federal funds and donations.

GOALS AND POLICIES

GOALS AND POLICIES

GOAL COS-21

Park and Recreational Facilities. Park and recreation facilities that enhance the quality of life and meet the diverse active and passive recreational needs of County residents and visitors, protect natural resources, and foster an awareness of local history, with approximately ten acres of local parks and 15 acres of regional parks provided for every 1,000 persons in the unincorporated County.



The historic Rancho Guajome Adobe, Guajome County Park

Policies

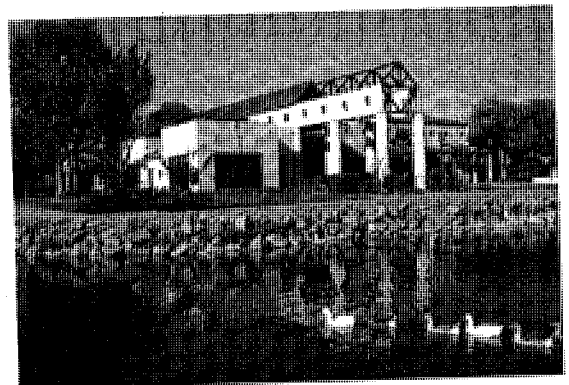
- COS-21.1 Diversity of Users and Services.** Provide parks and recreation facilities that create opportunities for a broad range of recreational experiences to serve user interests.
- COS-21.2 Location of Parks.** Locate new local parks and recreation facilities near other community-oriented public facilities such as schools, libraries, and recreation centers where feasible, so that they may function as the "heart" of a community.
- COS-21.3 Park Design.** Design parks that reflect community character and identity, incorporate local natural and cultural landscapes and features, and consider the surrounding land uses and urban form and cultural and historic resources.
- COS-21.4 Regional Parks.** Require new regional parks to allow for a broad range of recreational activities and preserve special or unique natural or cultural features when present.
- COS-21.5 Connections to Trails and Networks.** Connect public parks to trails and pathways and other pedestrian or bicycle networks where feasible to provide linkages and connectivity between recreational uses.

GOAL COS-22

Park and Recreational Services. High-quality parks and recreation programs that promote the health and well-being of County residents while meeting the needs of a diverse and growing population.

Policies

- COS-22.1 Variety of Recreational Programs.** Provide and promote a variety of high quality active and passive recreation programs that meet the needs of and benefit County residents.



Lakeside Community Center



CHAPTER 5 CONSERVATION AND OPEN SPACE ELEMENT

GOAL COS-23

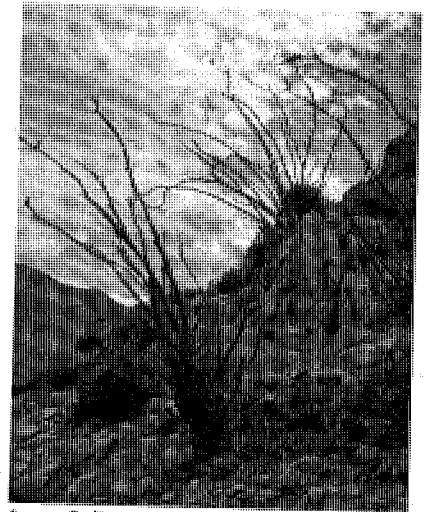
Recreational Opportunities in Preserves. Acquisition, monitoring, and management of valuable natural and cultural resources where public recreational opportunities are compatible with the preservation of those resources.

Policies

COS-23.1 Public Access. Provide public access to natural and cultural (where allowed) resources through effective planning that conserves the County's native wildlife, enhances and restores a continuous network of connected natural habitat and protects water resources.

COS-23.2 Regional Coordination. Coordinate the planning, acquisition, protection, development, and management of open space among governmental agencies and private organizations to maximize opportunities to link regional open space lands.

COS-23.3 Public Safety Involvement. Coordinate with public safety agencies to address safety concerns when planning the acquisition and management of open space.



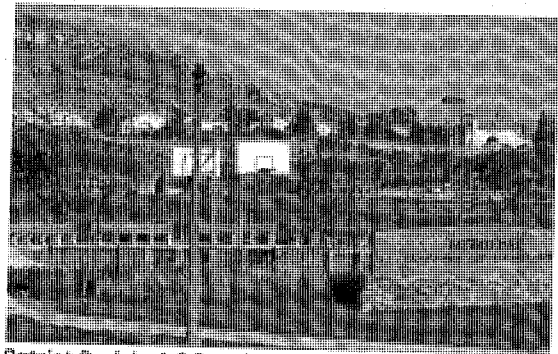
Agua Caliente County Park

GOAL COS-24

Park and Recreation Funding. Adequate funding for acquisition, development, maintenance, management, and operation of parks, recreation facilities, and preserves.

Policies

COS-24.1 Park and Recreation Contributions. Require development to provide fair-share contributions toward parks and recreation facilities and trails consistent with local, state, and federal law.



Patriot Park in 4-S Ranch

COS-24.2 Funding Opportunities. Maximize funding opportunities for the following:

- The acquisition, expansion, and development of parks, recreation facilities, preserves, and trails
- The operation, maintenance, and management of parks, recreation facilities, preserves, and trails

CHAPTER 3 **Land Use Element**



Introduction

The **Land Use Element** provides a framework to accommodate future development in an efficient and sustainable manner that is compatible with the character of unincorporated communities and the protection of valuable and sensitive natural resources.

Currently, the County of San Diego is faced with both significant growth pressures and severe environmental constraints. While population continues to grow, the supply of land capable of supporting development continues to decrease. In accommodating this growth, the land use plan encourages the provision of diverse housing choices while protecting the established character of existing urban and rural neighborhoods.

In general, the majority of new development—approximately 80 percent—is planned within the County Water Authority (CWA) boundary. This strategy coincides with the provision of imported water in San Diego County's semi-arid environment, and reflects the development pattern of the County's largest unincorporated communities, which are located in the County's western areas where demand for new development has and will continue to be greatest. The County's unincorporated communities and rural lands, however, exhibit tremendous diversity. This General Plan recognizes and encourages these unique identities by providing sufficient flexibility within a countywide framework to respect the character of individual communities, neighborhoods, and landscapes.

Focusing development in and around existing unincorporated communities allows the County to maximize existing infrastructure, provides for efficient service delivery, and strengthens town center areas while preserving the rural landscape that helps define the unique character of the unincorporated County.

Purpose and Scope

COUNTYWIDE

The Land Use Element is a framework that provides maps, goals, and policies that guide planners, the general public, property owners, developers, and decision makers as to how lands are to be conserved and developed in the unincorporated County. The first section, **Land Use Framework**, defines the categories of use to be permitted. These are defined at two scales: (a) broadly defined regional categories differentiated by character and overall density and (b) detailed categories that break-down the regional categories into more precise land use types, population densities, and development intensities. The Land Use Maps Appendix presents the **Land Use Map** depicting the allocation of these categories to all unincorporated County lands based on the General Plan's **Guiding Principles** in Chapter 2 (Vision and Guiding Principles). The Land Use Map serves as the regulatory document guiding land use, conservation, and development. The final section presents the goals and policies that carry out and amplify the intentions of the Land Use Map.

COMMUNITY PLANS

While the Land Use Element inclusive of Land Use Maps and Goals and Policies applies to all lands throughout the unincorporated County, there are special land use issues and objectives that uniquely pertain

INTRODUCTION

to each of its diverse communities. These are addressed by **Community Plans** in which goals and policies are defined to provide more precise guidance regarding the character, land uses, and densities within each community planning area. Though Community Plans are a part of this General Plan, they are bound separately and must be referenced in determining the types and density of land use that may be considered for any property within the community planning area.

PUBLIC INFRASTRUCTURE AND SERVICES

Public infrastructure such as roads, drainage facilities, sewer and water lines, and treatment plants are the structural framework that supports development. Their availability plays an important part in determining the pattern of land uses within a community, as well as the direction and intensity of growth. Community services such as law enforcement, fire protection, libraries, and parks are important to the safety and livability of communities. They can affect the well-being of communities and should also be accounted for when planning future growth.

Community services and infrastructure in the County of San Diego are either provided by the County or by independent agencies and special districts at the local, regional, state, and federal levels. Actions taken by these independent districts for the planning, provision, and funding of public facilities are not subject to the County's land use authority. The County does operate and maintain several dependent sanitation districts and wastewater facilities. In addition, some regional public facilities, such as courthouses, are under the authority of the County and serve the entire San Diego region, including residents of the County's 18 cities. Also, the County operates the library system for all unincorporated areas, along with some incorporated jurisdictions.

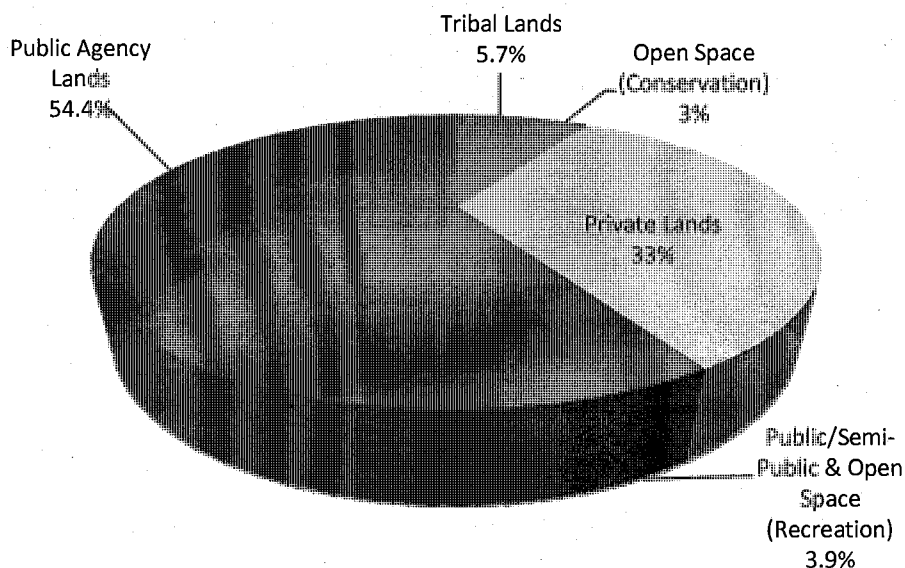
This element includes a **Community Services and Infrastructure** section. Goals and policies specific to services or infrastructure that correspond to other elements can be found in those elements. Refer to the Mobility Element for transportation-related infrastructure, the Conservation and Open Space Element for recreational facilities, and the Safety Element for emergency services and law enforcement.

Land Use Setting

The unincorporated portion of San Diego County is located in the southwestern corner of California and encompasses approximately 2.3 million acres, or 3,570 square miles. A majority of the unincorporated County's land, in excess of 90 percent, is either open space or undeveloped. This includes several large federal, state, and regional parklands that encompass much of the eastern portion of the County. Only 35 percent or about 807,000 acres of the unincorporated County is privately owned. In 2007, it was estimated that approximately 5.6 percent of the unincorporated County, or 128,369 acres, was private undeveloped land with potential for future development in Village, Semi-Rural, Commercial, or Industrial areas.



Land Ownership in the Unincorporated County



SOURCE: County of San Diego DPLU 2011

The predominant pattern of development in the unincorporated County is rural in character, offering a choice in use and lifestyle different from the urbanized coastal and inland communities. Dispersed throughout the unincorporated County are over 20 distinct communities that vary in land use and density. In general, the communities include a core of local-serving commercial uses, services, schools, and public facilities surrounded by residential neighborhoods. They vary from "semi-suburban" communities that transition in scale and density from adjoining incorporated cities to low-density "village" centers surrounded by agricultural lands and open spaces. Some of the communities are uniquely defined by their setting in hillside areas, the desert valley, and agricultural areas.

The most developed communities are located along the unincorporated territory's westernmost boundaries and include the community plan areas of Spring Valley, Sweetwater, Valle de Oro, Lakeside, San Dieguito, portions of North County Metro, and Fallbrook. These areas are largely within the County Water Authority service area and have had access to water, sewer, roads, schools, and comparable public facilities, enabling them to grow at a faster rate. As such facilities are more costly and difficult to develop as distances increase further inland, development occurs more sparsely in the backcountry region.

Guiding Principles for Land Use

The Land Use Element's maps and goals and policies are based on and amplify the Guiding Principles specified in Chapter 2 of the General Plan. Central to the land use concept for unincorporated San Diego County is a development pattern that balances the land requirements of residential growth, with those of commerce, agriculture, recreation, and wildlife habitats.

The location and densities of land uses, as depicted on the Land Use Map, are based on an analysis of development constraints such as road access, available water/sewer services, topography, significant

INTRODUCTION

habitats, groundwater resources, hazards, and accessibility to emergency fire protection services. Using these factors in defining permitted land use locations and densities is consistent with the County's Strategic Initiatives (which include safe livable communities and the environment) and *California Government Code* requirements. This approach will promote health and well being, while reducing environmental impacts that would likely result from locating development in inappropriate locations.

Within these constraints, the core concept for the County's development directs future growth to areas where existing or planned infrastructure and services can support growth and locations within or adjacent to existing communities. By giving priority to areas identified for urban level densities, this concept also helps to retain the rural setting and lifestyle of remaining areas of the County. Most areas that are appropriate for growth are located within the CWA boundary, while future development outside that boundary is limited. To decrease potential development outside the CWA boundary and areas without infrastructure and services, residential densities will typically be reduced where land is not already subdivided.

The Land Use Element establishes a model for community development based on a physical structure defining communities by a "village center" surrounded by semi-rural or rural land. In communities inside the CWA boundary, higher density neighborhoods and a pedestrian-oriented commercial center would provide a focal point for commercial and civic life. Medium-density, single-family neighborhoods, as well as a broad range of commercial or industrial uses, would surround the commercial core. Semi-rural neighborhoods surrounded by greenbelts, agricultural uses, or other rural lands would be located outside the more urbanized portion of the community.

Relationship to Other GP Elements

In many respects, the issues, goals, and policies discussed in the Land Use Element represent the synthesis of those of all or most other General Plan elements. Nearly any issue that deals with the physical characteristics of the land has implications for land use conservation and development. Recognition and understanding of the interrelationship between the Land Use Element and these other elements is necessary to assure an integrated and cohesive General Plan. The following describes the interrelationships between these elements:

- **Mobility Element**—The Mobility Element provides the backbone of roads, bike routes, and trails that support the uses designated by the Land Use Element, connect the communities, and are linked within the region. The capacity required for the road network is based on the average number of daily vehicle trips that would be generated with build-out of the uses designated by the Land Use Map, in consideration of infrastructure costs, environmental constraints, and community compatibility. Goals and policies of the Land Use Element closely consider the design, characteristics, and availability of transportation infrastructure addressed by the Mobility Element to assure their compatibility with the character and needs of the communities.
- **Housing Element**—The Land Use Element is closely related to the Housing Element in that the Land Use Map must provide sufficient capacity to meet goals of the State Housing Law including the Regional Housing Needs Assessment. It establishes the distribution of residential growth and densities appropriate for a range of housing types and affordability.
- **Conservation / Open Space Element**—The Conservation and Open Space Element provides measures for the preservation, conservation, development, and use of natural resources. In turn, these influence



the distribution and density of use depicted by the Land Use Map. Additionally, the Land Use Map incorporates designations that support the conservation and preservation of natural resources.

- **Safety Element**—The Safety Element identifies and maps hazards and provides hazard-specific goals and policies to more clearly guide land use to protect life and property from potential hazards. The Land Use Element goals, policies, and map minimize future development in hazardous areas.
- **Noise Element**—The Noise Element establishes noise compatibility guidelines that are applied to future development. In addition, noise compatibility concerns were taken into account during development of the Land Use Map.

Land Use Framework

The General Plan guides the intensity, location, and distribution of land uses in the unincorporated County through a two-tier land use framework. The first tier, **Regional Categories**, establishes a hierarchy for the overall structure and organization of development that differentiates areas by overall character and density, while the second tier, **Land Use Designations**, disaggregates these categories and provide more precise direction regarding the planned density and intensity of residential, commercial, industrial, open space, and public land uses. This framework establishes the range and intensity of allowable land uses, for all areas under the County of San Diego's land use jurisdiction. Unincorporated San Diego County contains numerous lands that are outside the land use jurisdiction of the County, such as tribal lands, military installations, public utility lands, State parks, and national forests. Examples of these lands include the Cleveland National Forest, Anza-Borrego State Park, Cuyamaca Rancho State Park, Palomar Mountain State Park, Marine Corps Base Camp Pendleton, and 18 different tribal reservations. While the land use framework does not apply to these lands, the present and planned uses on these lands were considered in its development and assignment of the Regional Categories and Land Use Designations. Additionally, this element contains goals and policies that relate to the planning and development of these lands.

The Community Development Model

A major component to guiding the physical planning of the County is the **Community Development Model** (discussed in Chapter 2). The Community Development Model is implemented by three regional categories—Village, Semi-Rural, and Rural Lands—that broadly reflect the different character and land use development goals of the County's developed areas, its lower-density residential and agricultural areas, and its very low-density or undeveloped rural lands (see Figure LU-1 [Regional Categories Map] at the end of the section). The Community Development Model directs the highest intensities and greatest mix of uses to **Village** areas, while directing lower-intensity uses, such as estate-style residential lots and agricultural operations, to **Semi-Rural** areas. The Semi-Rural category may effectively serve as an edge to the Village, as well as a transition to the lowest-density category, **Rural Lands**, which represents large open space areas where only limited development may occur.

The three regional categories are described further in the following section. As a broad set of development classifications, the Regional Categories do not specify allowable land uses, but rather the general regional structure, character, scale, and intensity of development. The Regional Categories allow many different land

LAND USE FRAMEWORK

use types to be planned in a more unified, regional manner. As a result, they do not regulate allowed uses or intensities of individual development proposals. Instead, they are intended to provide a structure for the location of specific Land Use Designations, described later in this element, that define allowed type and intensity of uses.

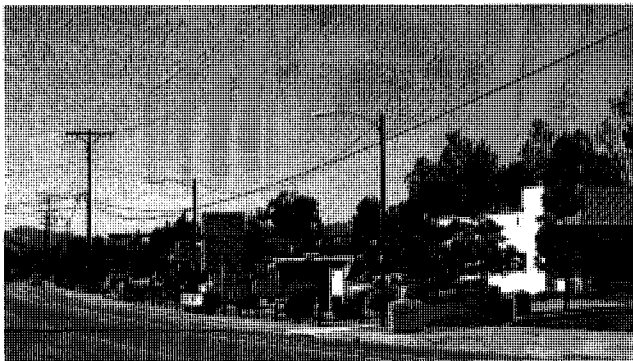
To facilitate a regional perspective, the Regional Categories of Village, Semi-Rural Lands, and Rural Lands have been applied to all privately-owned lands within the unincorporated County, along with Open Space (Recreation) and Open Space (Conservation) which are included under the Semi-Rural and Rural Lands categories, respectively. Tribal Lands, Federal and State Lands (including MCB Camp Pendleton) and Public/Semi-Public lands are assigned to the No Jurisdiction Regional Category. As shown in Figure LU-1, approximately 2.3 percent of the County is designated as Village, 10.3 percent as Semi-Rural, 36.7 percent as Rural Lands, and 50.7 percent as No Jurisdiction.¹

Regional Categories

As stated above, the Regional Categories provide a framework for the regional distribution of uses that serves as the foundation for the Land Use Map designations, goals, policies, and regulations that guide future development.

VILLAGE

The Village category identifies areas where a higher intensity and a wide range of land uses are established or have been planned. Typically, Village areas function as the center of community planning areas and contain the highest population and development densities. Village areas are typically served by both water and wastewater systems. Ideally, a Village would reflect a development pattern that is characterized as compact, higher density development that is located within walking distance of commercial services, employment centers, civic uses, and transit (when feasible).



Alpine Boulevard serves as the primary circulation route in the village of Alpine



Rural Village of Pine Valley in the Central Mountain Subregion

Generally, larger Villages are anchored by “Town Center” areas that serve as focal points for commercial and civic life. Town Centers often benefit from the development of more detailed plans to guide new

¹ These percentages are based off the Draft Land Use Map, and will be updated based upon what Land Uses are adopted by the Board of Supervisors.



CHAPTER 3 LAND USE ELEMENT

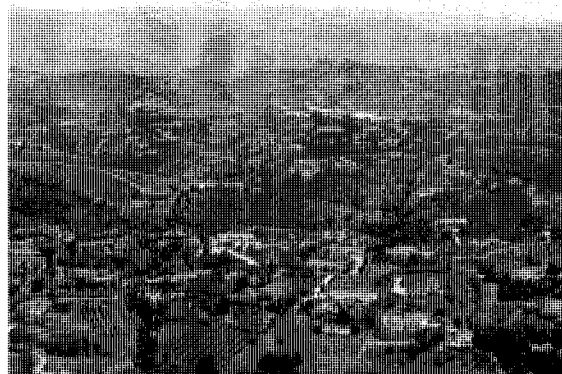
development in achieving consistency with the goals and policies of the General Plan. A Town Center will typically contain one or more of the following:

- Pedestrian-oriented commercial area
- Mixed-use development: residential, retail, and office/professional uses
- Higher-density residential developments
- Community-serving private and public facilities

Transit Nodes typically encompass lands within walking distance—approximately one-half mile—of future rapid transit stations and should be located within a Village. These may be planned as diverse, mixed-use areas with a range of residential, commercial, and where appropriate, employment-generating land uses (e.g., office/professional or industrial) as well as parks and civic spaces. However, planning must be consistent with the type and quantity of ridership expected of the node as well as the surrounding community. Potential Transit Node locations are based on long-range transit plans and include rail stations as well as express bus stops that feed into rail systems.

SEMI-RURAL

The Semi-Rural category identifies areas of the County that are appropriate for lower-density residential neighborhoods, recreation areas, agricultural operations, and related commercial uses that support rural communities. Semi-Rural areas often function as a transition between the Village and Rural Lands categories, providing opportunities for development, but without the intensity and level of public services expected in Villages and with design approaches that blend the development with the natural landscape. Semi-Rural residential densities are derived in consideration of the physical conditions, community character, and availability of public services, roads, and other infrastructure. Higher densities within the allowable range should be located near Village areas, while lower densities should be located near Rural Land areas. Site design methods that reduce on-site infrastructure costs and preserve contiguous open space or agricultural operations are encouraged.



Semi-rural development patterns in Bonsall community



View of the Cuyamaca Reservoir and rural community

RURAL LANDS

The Rural Lands category is applied to large open space and very-low-density private and publicly owned lands that provide for agriculture, managed resource production, conservation, and recreation and thereby retain the rural character for which much of unincorporated County is known. Rural areas are not appropriate for intensive residential or commercial uses due to significant topographical or environmental constraints, limited access, and the lack of public services

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or facilities. Further, the undeveloped nature of Rural Lands benefits all of San Diego County by doing the following:

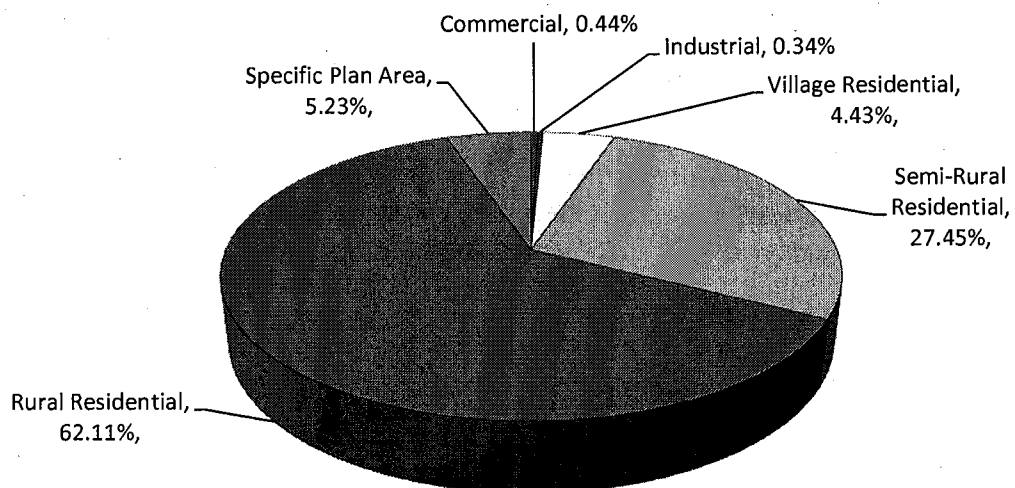
- Preserving the County's rural atmosphere
- Protecting land with significant physical or environmental constraints or hazards
- Preserving open space, farmland, and natural resources
- Providing open space buffers and a visual separation between communities
- Preserving and providing land for agricultural opportunities
- Preventing sprawl development, which reduces vehicle miles traveled and greenhouse gas emissions

Land Use Designations

Where the Regional Categories represent a broad framework for the form and organization of development, the Land Use Designations are property specific and identify the type and intensity of land uses that are allowed. The Land Use Designations are defined by the land use type—Residential, Commercial or Industrial—and the maximum allowable residential density or nonresidential building intensity. The designations are applied throughout the County, as shown on Land Use Maps, which are located in the Land Use Maps Appendix. More specific standards may be established for each Land Use Designation to implement the goals and policies of the General Plan, through such tools as the Zoning Ordinance, to address impacts related to specific land uses or the needs of an individual community.

Assignment of the land use designations to lands in the County is guided by the goals and policies contained in this element, which reflect the Guiding Principles presented in Chapter 2. A general summary of the designations is shown on the Land Use Maps in the Land Use Maps Appendix. The pie chart shown below depicts how the privately owned lands are designated.

Land Use Designations for Privately Owned Lands in the Unincorporated County



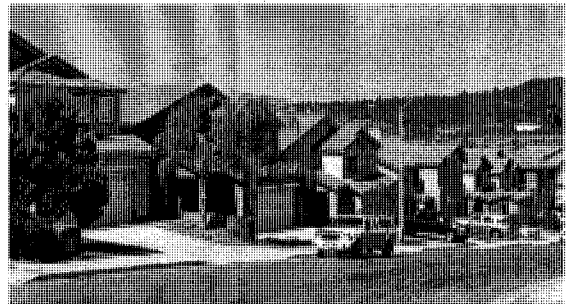


CHAPTER 3 LAND USE ELEMENT

Development within **Residential, Commercial, Industrial, Specific Plan Areas, and Public/Semi-Public** General Plan land use designations is regulated through either a maximum residential density or building intensity. **Residential density** is expressed as a maximum number of dwelling units per gross acre (exclusive of public roads and rights-of way). **Nonresidential building intensity** is expressed as a maximum floor-area ratio (FAR). A **floor-area ratio (FAR)** is the ratio of the gross building square footage on a lot to the net square footage of the lot or parcel (listed in Table LU-1 [Land Use Designations and Compatible Regional Categories]). For example, on a lot with 10,000 net square feet of land area, an FAR of 1.00 will allow 10,000 square feet of gross building area, regardless of the number of stories in the building. When combined with height and setback standards in the Zoning Ordinance, a maximum FAR can also be clearly translated into limits on building mass and bulk. In addition to density/intensity standards, some land use classifications also stipulate allowable building types, such as single-family residential, to respect the character of certain existing and planned neighborhoods.



Multifamily housing in 4S Ranch



Single-family residential at 7.3 dwelling units per acre

RESIDENTIAL LAND USE DESIGNATIONS

Seventeen residential land use designations provide for a full range of housing types, from village multi-family development to rural single-family housing. As noted previously, residential densities are stated as a maximum number of housing units per gross acre with the provision that at least one dwelling unit may be built on each existing legal lot designated for residential use. The stated maximum residential density may or may not be achievable in a given area due to local site conditions and constraints. In addition to these primary residential designations, residential uses are also permitted in certain commercial designations as specified in the Zoning Ordinance.

Second dwelling units are allowed pursuant to the Zoning Ordinance and are in addition to the maximum densities otherwise permitted.

VILLAGE RESIDENTIAL DESIGNATIONS

Nine residential land use designations are applied within the Village regional category ranging from two to 30 dwelling units per gross acre. Village residential densities are not subject to density reductions based on slope. The residential densities permitted within Village areas typically require water and wastewater service and can support a range of housing types including single-family and multifamily housing. Generally, residential densities of 10.9 dwelling units per gross acre or higher require multi-family development. Typically, multi-family development is characterized as attached apartments or condominiums that are two to three stories in height. The higher densities may require structured or underground parking.

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Table LU-1 Land Use Designations and Compatible Regional Categories					
Designation	Maximum Density	Maximum FAR ^a	Compatible Regional Category		
			Village	Semi-Rural	Rural Lands
Village Residential					
Village Residential 30 (VR-30)	30 units per gross acre	—	X		
Village Residential 24 (VR-24)	24 units per gross acre	—	X		
Village Residential 20 (VR-20)	20 units per gross acre	—	X		
Village Residential 15 (VR-15)	15 units per gross acre	—	X		
Village Residential 10.9 (VR-10.9)	10.9 units per gross acre	—	X		
Village Residential 7.3 (VR-7.3)	7.3 units per gross acre	—	X		
Village Residential 4.3 (VR-4.3)	4.3 units per gross acre	—	X		
Village Residential 2.9 (VR-2.9)	2.9 units per gross acre	—	X		
Village Residential 2 ^b (VR-2)	2 units per gross acre	—	X		
Semi-Rural					
Semi-Rural 0.5 ^b (SR-0.5)	1 unit per 0.5, 1, or 2 gross acre	—	X	X	
Semi-Rural 1 ^c (SR-1)	1 unit per 1, 2, or 4 gross acres	—	X	X	
Semi-Rural 2 ^c (SR-2)	1 unit per 2, 4, or 8 gross acres	—	X	X	
Semi-Rural 4 ^c (SR-4)	1 unit per 4, 8, or 16 gross acres	—	X	X	
Semi-Rural 10 ^c (SR-10)	1 unit per 10 or 20 gross acres	—	X	X	
Rural Lands					
Rural Lands 20 (RL-20)	1 unit per 20 gross acres	—	X	X	X
Rural Lands 40 (RL-40)	1 unit per 40 gross acres	—	X	X	X
Rural Lands 80 (RL-80)	1 unit per 80 gross acres	—	X	X	X
Commercial					
General Commercial (C-1)	— ^e	0.45 or 0.70 ^a	X	X	
Office Professional (C-2)	— ^e	0.45 or 0.80 ^a	X	X	
Neighborhood Commercial (C-3)	— ^e	0.35 or 0.65 ^a	X	X	
Rural Commercial (C-4)	2 units per gross acre	0.35 or 0.60 ^a	X	X	X
Village Core Mixed Use (C-5)	30 units per gross acre ^d	0.70 ^d	X		
Industrial					
Limited Impact Industrial (I-1)	— ^e	0.60	X	X	
Medium Impact Industrial (I-2)	0	0.50	X	X	X
High Impact Industrial (I-3)	0	0.35	X	X	X
Other					
Tribal Lands (TL)	— ^f	—	X	X	X
Public Agency Lands	— ^{f, h}	—	X	X	X
Specific Plan Area (SPA) ^g	refer to individual SPA	—	X	X	X
Public/Semi-Public Facilities (P/SP)	— ^h	0.50	X	X	X
Open Space—Conservation (OS-C)	0	—	X	X	X
Open Space—Recreation (OS-R)	1 unit per 4, 8, or 16 gross acres ⁱ	—	X	X	X

- Maximum floor area ratio is provided based on regional categories to guide intensity of development. Community Plans may specify specific areas where these FARs may be exceeded such as areas with shared parking facilities or mixed uses, areas in or around town centers or transit nodes, or when other special circumstances exist.
- Village Residential 2 (VR-2) and Semi-Rural 0.5 (SR-0.5) currently appear as one designation on the Land Use Map but are differentiated on the Regional Categories Map. The Land Use Map will be updated to reflect the different designations prior to finalization. Semi-Rural 0.5 is appropriate in the Semi-Rural Regional Category in areas where the predominant development pattern is 0.5-acre and larger parcels.
- The maximum density for lands designated as Semi-Rural is based on the slope of the site (see Table LU-2).
- This denotes the upper range for each component, but there is no expectation that this would be achieved when each component is applied in the same area. The maximum FAR in the Village Core Mixed Use Designation is 0.7 unless offsite parking is provided in conjunction with the proposed development. In that case, the maximum FAR could be up to 1.3.
- Maximum residential densities are applied per the Zoning Ordinance.
- The reflection of existing land uses on the Land Use Map results in some land use designations that are not consistent with the compatibility set forth in this table. This exception is available to existing land uses only.
- This designation solely reflects those designations retained from the former General Plan. New SPAs will not be shown on the Land Use Map under the SPA designation, rather these areas will retain their underlying land uses.
- Refer to Policy LU-1.6
- Residential uses would not occur within this designation unless the proposed development has been carefully examined to assure that there will be no significant adverse environmental impacts, and erosion and fire problems will be minimal.



SEMI-RURAL RESIDENTIAL DESIGNATIONS

Five residential land use designations are applied within Semi-Rural regional category (refer to Table LU-1). Semi-Rural densities range from one dwelling unit per 0.5 acre to one dwelling unit per ten gross acres. Residential development within Semi-Rural areas is not typically served by municipal sewer systems, but is often served by municipal water systems especially where water-intensive crops such as avocado and citrus are common.



Examples of semi-rural residential at one to two dwelling units per acre

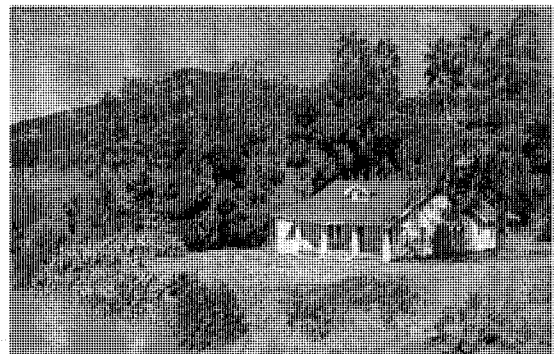
In an effort to balance the allowance of reasonable use of property on lands constrained by steep slopes, the maximum allowable residential densities for the five Semi-Rural designations are reduced according to Table LU-2 (Density Formula for Slope-Dependent Lands).

Table LU-2 Density Formula for Slope-Dependent Lands			
Land Use Designation	Slope less than 25%	Slope 25% to less than 50%	Slope 50% or greater
Semi-Rural 0.5	2 du/gross acre	1 du/gross acre	1 du/2 gross acres
Semi-Rural 1	1 du/gross acre	1 du/2 gross acres	1 du/4 gross acres
Semi-Rural 2	1 du/2 gross acres	1 du/4 gross acres	1 du/8 gross acres
Semi-Rural 4	1 du/4 gross acres	1 du/8 gross acres	1 du/16 gross acres
Semi-Rural 10	1 du/10 gross acres	1 du/20 gross acres	1 du/20 gross acres

Density calculations shall be based on a topographic map with 10-foot contour intervals or less. To calculate maximum density for a property the acreage of the property should be divided into the above three categories (<25%, 25–50%, >50%), each total should be multiplied by the associated density, and then the resulting yields combined.
du = dwelling unit

RURAL LANDS RESIDENTIAL DESIGNATIONS

Four residential land use designations are applied within the Rural Lands regional category. The densities provided by these designations are the lowest in the unincorporated County—ranging from one dwelling unit per 20 gross acres, to one dwelling unit per 80 gross acres—and are intended to reflect and preserve the rural agricultural, environmentally constrained, and natural “backcountry” areas of the County (see Table LU-1). Residential development within the Rural Lands category is typically not served by either municipal water and or municipal sewer systems.



House on a large lot in a rural area of County

NONRESIDENTIAL LAND USE DESIGNATIONS

Eight nonresidential land use designations provide for commerce and employment in the unincorporated County. The maximum development intensity of uses in these designations is expressed as a maximum FAR (see Table LU-1). As these are expressed as maximums, in many communities the desired FAR will likely be lower. Similarly, in specific areas (identified by Community Plans) it may be appropriate to accommodate an increased FAR to meet specific development objectives, such as areas with shared parking facilities, mixed uses, or around Town Centers or Transit Nodes. Detailed regulations specified in the Zoning Ordinance will support the desired development intensity. In any case, the permitted development intensity must be supportive of the goals and policies of the General Plan and the applicable Community Plan.

While zoning regulations and site constraints may reduce development potential within the allowable range, zoning can also provide specific exceptions to the FAR limitations, such as FAR bonuses in return for the provision of public amenities or other community benefits. Illustrative public amenities and benefits include public parks and affordable housing units.

COMMERCIAL DESIGNATIONS

General Commercial. This designation provides for commercial areas where a wide range of retail activities and services are permitted. This designation is appropriate for the following types of commercial areas: (1) regional shopping centers, (2) community shopping centers, and (3) existing strip development or commercial clusters containing small but diverse commercial uses. Uses permitted within this designation are typically limited to commercial activities conducted within an enclosed building. Residential development may also be allowed as a secondary use in certain instances. The maximum intensity of General Commercial development varies according to the compatible regional category as follows:

- Village—0.70 FAR
- Semi-Rural—0.45 FAR

Neighborhood Commercial. This designation provides locations for limited, small-scale retail sales and service uses intended to meet the convenience needs of local residents. The limited commercial uses allowed under this designation should be considered in contrast to the larger scale and more broadly serving General Commercial designation. Neighborhood Commercial establishments should be compatible in bulk and scale with adjacent residential



Shopping center in the Valle de Oro community



Neighborhood Commercial use in the Crest community

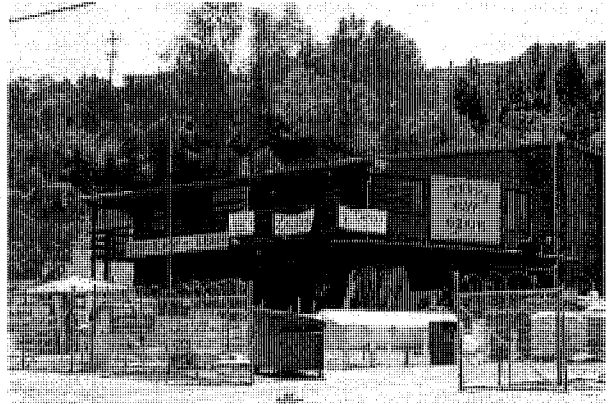


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neighborhoods. Residential development may also be allowed as a secondary use in certain instances. The maximum intensity of Neighborhood Commercial development varies according to the compatible regional category as follows:

- Village—0.65 FAR
- Semi-Rural—0.35 FAR

Rural Commercial. This designation provides for small-scale commercial and civic development. Mixed-use development may take the form of small offices or residences up to two units per gross acre (as further specified by the Zoning Ordinance) either above ground-floor retail uses or separated structures typically with commercial or civic uses located along the road frontage. A wide variety of local serving commercial and civic uses is encouraged by this designation, including: retail stores; visitor-oriented services; automotive sales and services; eating and drinking establishments; professional offices; business and personal services; and parks, libraries, and other community facilities. The maximum intensity of Rural Commercial development varies according to the compatible Regional Category as follows:



Rural Commercial use in Valley Center

- Rural Village—0.60 FAR
- Semi-Rural and Rural Lands—0.35 FAR



Mixed uses along Main Avenue in Fallbrook

Village Core Mixed Use. This designation is intended for pedestrian-scaled town center development. A wide variety of commercial, civic, and residential uses are encouraged by this designation, and these uses may be mixed “vertically”—on separate floors of a building—or “horizontally”—in separate buildings on a single site or on adjacent parcels. To maintain a pedestrian scale and orientation, retail and other active uses are encouraged at street level. Structured parking may be necessary to accommodate allowable densities, and shared

parking arrangements may be allowed consistent with the nature of the mixed uses. Specific maximum FAR and residential density standards shall be developed through community-specific town center planning, though in no case, within either multiple- or single-use buildings, may nonresidential intensities exceed 1.3 FAR or residential densities exceed 30 units per acre. Permitted uses must be consistent with the town center plan, or in absence of a town center plan, shall not preclude the development and implementation of such a plan.

LAND USE FRAMEWORK

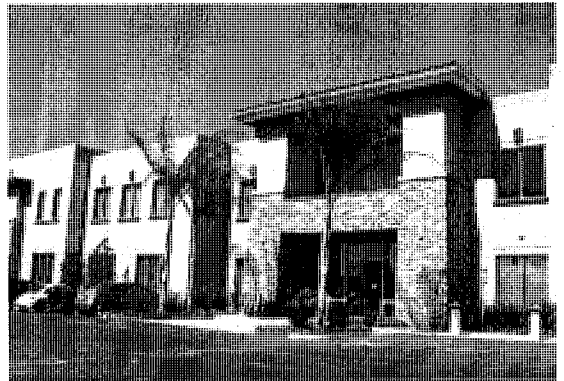
Office Professional. This designation provides areas dedicated to administrative and professional services as well as limited retail uses related to or serving the needs of the primary office uses. Residential development may also be allowed as a secondary use in certain instances. The maximum intensity of Office Professional development varies according to compatible regional category as follows:

- Village—0.80 FAR
- Semi-Rural—0.45 FAR

INDUSTRIAL DESIGNATIONS

Limited-Impact Industrial. This designation provides for both freestanding and campus-style industrial development in Village and Semi-Rural areas with access to key transportation corridors at a maximum FAR of 0.60. Typical uses within this designation include light manufacturing, processing, and assembly, all within enclosed buildings, with no exterior indications of such activity or need for outdoor storage. This designation may be located in close proximity to residential and commercial designations in Village and Semi-Rural areas with suitable screening and buffering. Supporting uses—such as office, business service, and institutional uses—and accessory retail uses are also allowed.

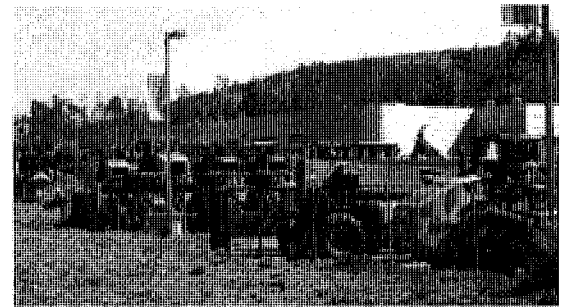
Medium-Impact Industrial. This designation provides for freestanding industrial development in all Regional Category areas with access to key transportation corridors at a maximum FAR of 0.5. Typical uses within this designation include: manufacturing, processing, and assembly; warehousing and distribution; large equipment supply and sales; and other industrial and commercial activities that are generally incompatible with dissimilar adjacent land uses. Uses in this designation may include outdoor operations or require significant outdoor storage of process materials and product. This designation should generally not be located in close proximity to residential and commercial designations in Village areas, because significant screening and buffering will typically be required to minimize unacceptable off-site impacts. Supporting uses are allowed in this designation, including business services.



Office complex in Rancho San Diego



Public storage facility in Spring Valley

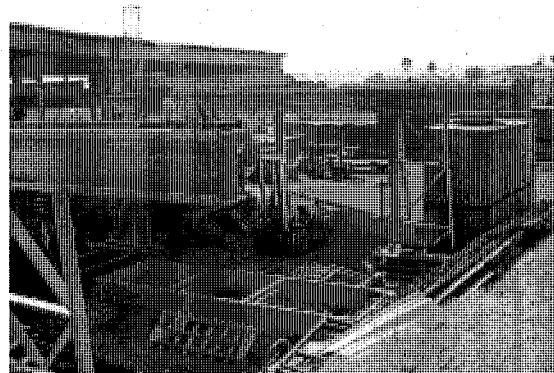


Medium-Impact Industrial use with outdoor storage in 4S Ranch



CHAPTER 3 LAND USE ELEMENT

High-Impact Industrial. This designation provides for freestanding industrial development in areas with access to key transportation corridors at a maximum FAR of 0.35. Typical uses within this designation are similar to those of the Medium Impact Industrial designation and include: manufacturing, processing, and assembly; warehousing and distribution; large equipment supply and sales; and other industrial and commercial activities that are generally incompatible with dissimilar adjacent land uses. However, the off-site impacts of industrial uses in this designation are likely to be more significant due to process,



Steel fabricating plant in Spring Valley

product, and reliance on outdoor operations or storage of process materials and product. Therefore, this designation may be incompatible with most Village areas and must be thoughtfully applied in any location in the unincorporated area. In certain limited circumstances it may be designated near the periphery of Village areas where the industrial use is isolated from residential and commercial designations and all allowed uses are adequately screened and buffered to eliminate unacceptable off-site impacts. Secondary support uses are also allowed in this designation, including related business and industrial services.

OTHER LAND USE DESIGNATIONS

Seven additional land use designations are applied in the General Plan to recognize other existing land use types and jurisdictions. Four designations—Specific Plan Areas, Public and Semi-Public Facilities, Open Space—Conservation, and Open Space—Recreation—generally relate to areas where the County or some other agency controls land under County jurisdiction to provide public facilities, such as schools, protect open space resources, or to serve recreational needs. Two other designations—Tribal Lands, and Federal and State lands—apply to areas where the County has no jurisdiction over land use.



Resort hotel, casino, and golf course on the Barona Reservation

Tribal Lands. These lands comprise about 126,000 acres, or five percent of the unincorporated County on 18 federally recognized reservations or Indian villages. Tribal lands are primarily located in Rural Areas.

Public Agency Lands (State Parks, National Forests and other public agency non-conservation lands). Public agency lands comprise 1,160,700 acres, or 50.8 percent, the majority of the unincorporated County land area. State Parks—including Anza-Borrego Desert State Park, Cuyamaca Rancho State Park, and Palomar Mountain State Park—and the Cleveland National Forest contribute significantly to the unique and unspoiled character of the County's backcountry. The County contains several military installations, including Marine Corps Base Camp Pendleton, which alone encompasses about 135,000 acres, or



Laguna Meadow within the Cleveland National Forest

LAND USE FRAMEWORK

six percent of the unincorporated County. These installations are designated as “Military Installations.” This category also includes lands owned by the Bureau of Land Management (BLM) and incorporated jurisdictions.

Specific Plan Area. This designation is applied to areas where a Specific Plan was adopted by the County prior to the adoption of this General Plan. Specific Plans may contain residential, commercial, industrial, public, institutional, and/or open space uses; and detailed land use regulations are contained within each adopted specific plan document. The designation of new Specific Plan Areas to substitute for General Plan Land Use Designations is not permitted. This is not intended to restrict the use of Specific Plans, which are useful planning tools allowed for by State law and may be developed for areas of the County to provide more precise guidance for land development, infrastructure, amenities, and resource conservation consistent with the use types and densities specified by the Land Use Designations and the goals and policies of the General Plan. The intention is to retain the underlying densities on the General Plan Land Use Plan to clearly show the area’s relationship within the context where it is located.

Public and Semi-Public Facilities. This designation identifies major facilities built and maintained for public use. Examples include institutional uses, academic facilities, governmental complexes, and community service facilities, such as County airports, public schools, correctional institutions, solid waste facilities, water facilities, and sewer facilities. This designation may include privately owned facilities built and maintained for public use, such as hospitals, cemeteries, and landfills. A maximum FAR of 0.50 is permitted by this designation.



Post office in the rural village of Pine Valley

Public/Semi-Public Lands (Solid Waste Facility). This designation occurs on two sites in the County: the Gregory Canyon and East Otay Mesa landfill sites. On November 8, 1994, the voters adopted County of San Diego Initiative Proposition C, which amended the General Plan and re-designated the Gregory Canyon site. Similarly, on June 8, 2010, the voters adopted County of San Diego Initiative Proposition A, which re-designated the East Otay Mesa Site. Both initiatives assigned a (22) Public/Semi-Public Lands designation with a Solid Waste Facility Designator based on the General Plan that was in effect at that time. Although that designation has since been amended in an updated General Plan, the previous designation has been retained for those two sites to comply with the voter-adopted ordinances.



Open space preserved in Mountain Empire Subregion

Open Space—Conservation. This designation is primarily applied to large tracts of land, undeveloped and usually dedicated to open space, that are owned by a jurisdiction, public agency, or conservancy group. Allowed uses include habitat preserves, passive recreation, and reservoirs. Grazing and other uses or structures ancillary to the primary open space use may be permitted if they do not substantially diminish protected resources or alter the character of the



CHAPTER 3 LAND USE ELEMENT

area. Such ancillary uses within this designation will typically be controlled by use-permit limitations. Open space preserves total 159,400 acres or 7 percent of the total land area in the unincorporated County. Due to the success of the County's MSCP program, this number continues to grow.

This designation is not normally applied to conservation easements within residential subdivisions on private lots.

Open Space—Recreation. This designation is applied to large, existing recreational areas. This designation allows for active and passive recreational uses such as parks, athletic fields, and golf courses. Uses and structures ancillary to the primary open space use may be permitted to enhance recreational opportunities only if they relate to the recreational purpose and do not substantially alter the character of the area.



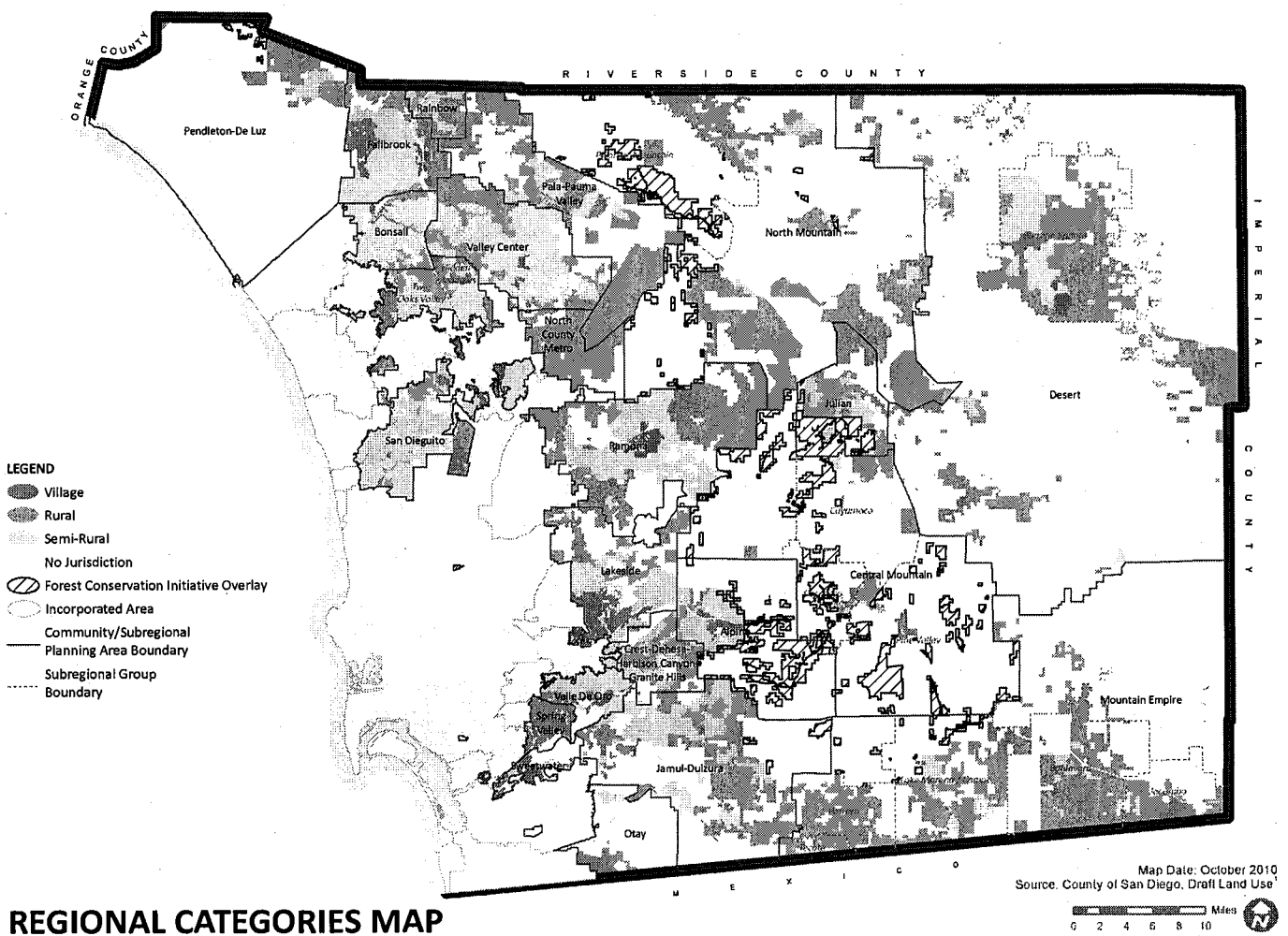
Valle de Oro Park

Forest Conservation Initiative Lands. This designation applies to lands affected by the Forest Conservation Initiative (FCI) of 1993. This initiative mandated specific land use designations, goals, and policies (provided in the Forest Conservation Initiative Appendix), which are in effect through December 31, 2010. Upon expiration of the FCI, the General Plan must be amended to remap the lands in conformance with this General Plan.

Regional Categories Map and Land Use Maps

The Regional Categories Map (Figure LU-1) and the Land Use Maps (located in the appendix) are graphic representations of the Land Use Framework and the related goals and policies of the General Plan. As required by State law, these depict the general distribution, location, and extent of the uses of the land for housing, business, industry, open space, education, public buildings, and other categories of public and private uses of the land. The land use designations are shown on these maps as color or graphic patterns and correspond directly to the designations shown on Table LU-1 and defined in the Land Use Designations section, including allowable uses and permitted development densities or intensities. These may be further modified by specific policies for the Community Plan Areas as specified by their respective Community Plan (separately bound as a part of this General Plan). As an adopted part of the General Plan, the Land Use Maps are to be used and interpreted only in conjunction with the text and other figures contained in the General Plan.

In the Land Use Maps Appendix are 35 land use maps. Of the 35 maps, 23 are regional maps, some of which have subarea maps that are within the geographic boundary of the subregion. These maps also correlate to the community plans, which are bound separately.



REGIONAL CATEGORIES MAP

San Diego County General Plan

Figure LU-1

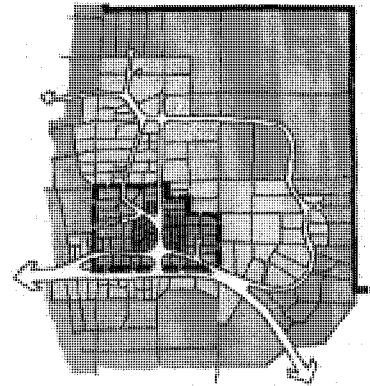


Goals and Policies for Land Use Element

The Community Development Model

CONTEXT

The General Plan Land Use Framework defines a Community Development Model that uses three regional categories—Village, Semi-Rural, and Rural Lands—to broadly reflect the differing character of County lands that range from communities with substantial populations to predominantly undeveloped backcountry areas. The goals and policies in this section implement the Community Development Model and are intended to apply across the entire unincorporated County and are the basis for assigning densities to these areas. Further, they recognize the diversity of the unincorporated communities and need for community-specific planning and guidance. Lastly, they acknowledge that planning by other agencies with responsibilities within, around, or overlapping the unincorporated lands will also affect how the Community Development Model is implemented. The Community Development Model is included in the Vision and Guiding Principles chapter under Guiding Principle 2, and discussed further in pages 3-4 and 3-5.



*Community Development Model
(refer to Guiding Principle 2)*

GOALS AND POLICIES

GOAL LU-1

Primacy of the Land Use Element. A land use plan and development doctrine that sustain the intent and integrity of the Community Development Model and the boundaries between Regional Categories.

Policies

- LU-1.1 Assigning Land Use Designations.** Assign land use designations on the Land Use Map in accordance with the Community Development Model and boundaries established by the Regional Categories Map. *Refer to Guiding Principle 2 for an explanation of the Community Development Model.*
- LU-1.2 Leapfrog Development.** Prohibit leapfrog development which is inconsistent with the Community Development Model. Leapfrog Development restrictions do not apply to new villages that are designed to be consistent with the Community Development Model, that provide necessary services and facilities, and that are designed to meet the LEED-Neighborhood Development Certification or an equivalent. For purposes of this policy, leapfrog development is defined as Village densities located away from established Villages or outside established water and sewer service boundaries. *[See applicable community plan for possible relevant policies.]*

GOALS AND POLICIES

- LU-1.3 Development Patterns.** Designate land use designations in patterns to create or enhance communities and preserve surrounding rural lands.
- LU-1.4 Village Expansion.** Permit new Village Regional Category designated land uses only where contiguous with an existing or planned Village and where all of the following criteria are met:
- Potential Village development would be compatible with environmental conditions and constraints, such as topography and flooding
 - Potential Village development would be accommodated by the General Plan road network
 - Public facilities and services can support the expansion without a reduction of services to other County residents
 - The expansion is consistent with community character, the scale, and the orderly and contiguous growth of a Village area
- LU-1.5 Relationship of County Land Use Designations with Adjoining Jurisdictions.** Prohibit the use of established or planned land use patterns in nearby or adjacent jurisdictions as the primary precedent or justification for adjusting land use designations of unincorporated County lands. Coordinate with adjacent cities to ensure that land use designations are consistent with existing and planned infrastructure capacities and capabilities.
- LU-1.6 Conversion of Public Lands to Private Ownership.** Assign lands in public use an underlying designation of Rural Lands 80. When such lands are transferred to private ownership, the RL-80 designation shall apply until the appropriate long-term use of the property is determined and a general plan amendment is approved for redesignation of the property. This policy applies to areas on the Land Use Map designated Public/Semi-Public Facilities, Federal and State Lands, and Tribal Lands.
- LU-1.7 Maximum Residential Densities.** Determine the maximum number of dwelling units permitted within the boundaries of any subdivision or single lot based on the applicable land use designation(s). When the total number of dwelling units is less than one, this shall be interpreted as permitting one dwelling unit. When more than one dwelling unit is permitted, fractional dwelling units are rounded down to the nearest whole number of dwelling units.
- LU-1.8 Density Allocation on Project Sites.** Permit changes in density within a project site with parcels that have more than one land use designation to provide flexibility in project design only when approved by Major Use Permit or Specific Plan. The policy does not allow a project to receive more units than is established by the Land Use Maps nor to supersede Housing Element requirements related to achieving the County's Regional Housing Needs Allocation. *[See applicable community plan for possible relevant policies.]*
- LU-1.9 Achievement of Planned Densities.** Recognizing that the General Plan was created with the concept that subdivisions will be able to achieve densities shown on the Land Use Map, planned densities are intended to be achieved through the subdivision process except in cases where regulations or site specific characteristics render such densities infeasible.

GOAL LU-2

Maintenance of the County's Rural Character. Conservation and enhancement of the unincorporated County's varied communities, rural setting, and character.



Policies

- LU-2.1 **Community Plans.** Maintain updated Community Plans, as part of the General Plan, to guide development to reflect the character and vision for each individual unincorporated community, consistent with the General Plan.
- LU-2.2 **Relationship of Community Plans to the General Plan.** Community Plans are part of the General Plan. These plans focus on a particular region or community within the overall General Plan area. They are meant to refine the policies of the General Plan as they apply to a smaller geographic region and provide a forum for resolving local conflicts. As legally required by State law, Community Plans must be internally consistent with General Plan goals and policies of which they are a part. They cannot undermine the policies of the General Plan. Community Plans are subject to adoption, review and amendment by the Board of Supervisors in the same manner as the General Plan.
- LU-2.3 **Development Densities and Lot Sizes.** Assign densities and minimum lot sizes in a manner that is compatible with the character of each unincorporated community.
- LU-2.4 **Relationship of Land Uses to Community Character.** Ensure that the land uses and densities within any Regional Category or Land Use Designation depicted on the Land Use Map reflect the unique issues, character, and development objectives for a Community Plan area, in addition to the General Plan Guiding Principles.
- LU-2.5 **Greenbelts to Define Communities.** Identify and maintain greenbelts between communities to reinforce the identity of individual communities.
- LU-2.6 **Development near Neighboring Jurisdictions.** Require that development in the proximity of neighboring jurisdictions retain the character of the unincorporated community and use buffers or other techniques where development in the neighboring jurisdiction is incompatible.
- LU-2.7 **Commercial Viability.** Ensure that new commercial centers maintain or enhance the viability of existing commercial areas.
- LU-2.8 **Mitigation of Development Impacts.** Require measures that minimize significant impacts to surrounding areas from uses or operations that cause excessive noise, vibrations, dust, odor, aesthetic impairment and/or are detrimental to human health and safety.
- LU-2.9 **Maintaining Rural Character.** Consider level of service criteria, in accordance with Policy M-2.1, to determine whether adding lanes to a Mobility Element road would adversely impact the rural character of a community or cause significant environmental impacts. In those instances, consider other options to mitigate LOS where appropriate.

GOAL LU-3

Diversity of Residential Neighborhoods. A land use plan that accommodates a range of building and neighborhood types suitable for a variety of lifestyles, ages, affordability levels, and design options.

Policies

- LU-3.1 **Diversity of Residential Designations and Building Types.** Maintain a mixture of residential land use designations and development regulations that accommodate various building types and styles.

GOALS AND POLICIES

- LU-3.2 Mix of Housing Units in Large Projects.** Require new large residential developments (generally greater than 200 dwelling units) to integrate a range of housing types and lot and building sizes. *[See applicable community plan for possible relevant policies.]*
- LU-3.3 Complete Neighborhoods.** Require new development sufficiently large to establish a complete neighborhood (typically more than 1,000 dwelling units) to include a neighborhood center within easy walking distance of surrounding residences. *[See applicable community plan for possible relevant policies.]*

GOAL LU-4

Inter-jurisdictional Coordination. Coordination with the plans and activities of other agencies and tribal governments that relate to issues such as land use, community character, transportation, energy, other infrastructure, public safety, and resource conservation and management in the unincorporated County and the region.

Policies

- LU-4.1 Regional Planning.** Participate in regional planning to ensure that the unique communities, assets, and challenges of the unincorporated lands are appropriately addressed with the implementation of the planning principles and land use requirements, including the provisions of SB375.
- LU-4.2 Review of Impacts of Projects in Adjoining Jurisdictions.** Review, comment, and coordinate when appropriate on plans, projects, and proposals of overlapping or neighboring agencies to ensure compatibility with the County's General Plan, and that adjacent communities are not adversely impacted.
- LU-4.3 Relationship of Plans in Adjoining Jurisdictions.** Consider the plans and projects of overlapping or neighboring agencies in the planning of unincorporated lands, and invite comments and coordination when appropriate.
- LU-4.4 Development Compatibility with Military Facilities.** Ensure compatibility of new development with the current and planned mission and operations of U.S. government military installations.
- LU-4.5 Annexations with Incompatible Land Uses.** Coordinate with LAFCO to oppose annexations by neighboring cities that would result in land uses incompatible with unincorporated lands.
LAFCO is responsible for coordinating, directing, and overseeing annexation of territory. A prerequisite for annexation is the inclusion of a territory within an adjacent city's sphere of influence.
- LU-4.6 Planning for Adequate Energy Facilities.** Participate in the planning of regional energy infrastructure with applicable utility providers to ensure plans are consistent with the County's General Plan and Community Plans and minimize adverse impacts to the unincorporated County.
- LU-4.7 Airport Land Use Compatibility Plans (ALUCP).** Coordinate with the Airport Land Use Commission (ALUC) and support review of Airport Land Use Compatibility Plans (ALUCP) for development within Airport Influence Areas.



Planning for Sustainability

CONTEXT

As discussed in Chapter 2, sustainability is a key theme of this General Plan and is inextricably related to a number of General Plan elements, as well as land use topics. Addressing global climate change through the reduction of GHG emissions is a common tenant of sustainability. The types, densities, and distribution of land uses in the County play a profound role in sustaining natural resources, the economy, and well being of residents. Land use patterns defined by the Community Development Model and Land Use Map provide for a more compact land use pattern, where residents live closer to jobs, businesses, schools, parks, services, and their neighbors, and would reduce vehicle trips and miles traveled. In turn, this would reduce energy consumption, air pollution, noise, and GHG emissions, while improving the quality of life for residents and economic activity of local businesses. Policies are also defined for the application of more sustainable approaches to land development, building design, and construction.

The County also recognizes sustainability as it applies to the other natural systems that are integrated with our communities. Ecosystems, topography, riparian corridors, rock formations, mature trees, and our natural assets such as our air, water (and groundwater), agriculture, and views are important contributing elements to sustainability.

This section focuses on general goal and policies that relate to the designation of land uses and the development that could occur based on those land use designations. Climate Change-related goals and policies are found throughout this General Plan. Table I-1 (General Plan Policies Addressing Climate Change) in the introduction summarizes by topic area the goals and policies in the County's General Plan that address reducing GHGs and adapting to climate change. The Air Quality, Climate Change, and Energy section of the Conservation and Open Space Element contains several goals and policies directly related to emissions reductions.

A complete reference to County General Plan Climate Change-related policies can be found in the Introduction Chapter in Table I-1 on page I-16.

GOALS AND POLICIES

GOAL LU-5

Climate Change and Land Use. A land use plan and associated development techniques and patterns that reduce emissions of local greenhouse gases in accordance with state initiatives, while promoting public health.

Policies

- LU-5.1 Reduction of Vehicle Trips within Communities.** Incorporate a mixture of uses within Villages and Rural Villages and plan residential densities at a level that support multi-modal transportation, including walking, bicycling, and the use of public transit, when appropriate.
- LU-5.2 Sustainable Planning and Design.** Incorporate into new development sustainable planning and design.

GOALS AND POLICIES

- LU-5.3 Rural Land Preservation.** Ensure the preservation of existing open space and rural areas (e.g., forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas) when permitting development under the Rural and Semi Rural Land Use Designations. *Open space and rural lands are primary areas that provide carbon sequestration benefits for the Region.*
- LU-5.4 Planning Support.** Undertake planning efforts that promote infill and redevelopment of uses that accommodate walking and biking within communities.
- LU-5.5 Projects that Impede Non-Motorized Travel.** Ensure that development projects and road improvements do not impede bicycle and pedestrian access. Where impacts to existing planned routes would occur, ensure that impacts are mitigated and acceptable alternative routes are implemented.

Examples include large parking areas that cannot be crossed by non-motorized vehicles, and new developments that block through access on existing or potential bicycle and pedestrian routes.

GOAL LU-6

Development—Environmental Balance. A built environment in balance with the natural environment, scarce resources, natural hazards, and the unique local character of individual communities.

Policies

- LU-6.1 Environmental Sustainability.** Require the protection of intact or sensitive natural resources in support of the long-term sustainability of the natural environment.
- LU-6.2 Reducing Development Pressures.** Assign lowest-density or lowest-intensity land use designations to areas with sensitive natural resources.
- LU-6.3 Conservation-Oriented Project Design.** Support conservation-oriented project design. This can be achieved with mechanisms such as, but not limited to, Specific Plans, lot area averaging, and reductions in lot size with corresponding requirements for preserved open space (Planned Residential Developments). Projects that rely on lot size reductions should incorporate specific design techniques, perimeter lot sizes, or buffers, to achieve compatibility with community character. *[See applicable community plan for possible relevant policies.]*
- Approval of Conservation-Oriented projects is not guaranteed by-right but shall be allowed to process if consistent with applicable minimum lot sizes, design guidelines, and regulations*
- LU-6.4 Sustainable Subdivision Design.** Require that residential subdivisions be planned to conserve open space and natural resources, protect agricultural operations including grazing, increase fire safety and defensibility, reduce impervious footprints, use sustainable development practices, and, when appropriate, provide public amenities. *[See applicable community plan for possible relevant policies.]*



CHAPTER 3 LAND USE ELEMENT

- LU-6.5 Sustainable Stormwater Management.** Ensure that development minimizes the use of impervious surfaces and incorporates other Low Impact Development techniques as well as a combination of site design, source control, and stormwater best management practices, where applicable and consistent with the County's LID Handbook.
- LU-6.6 Integration of Natural Features into Project Design.** Require incorporation of natural features (including mature oaks, indigenous trees, and rock formations) into proposed development and require avoidance of sensitive environmental resources.
- LU-6.7 Open Space Network.** Require projects with open space to design contiguous open space areas that protect wildlife habitat and corridors; preserve scenic vistas and areas; and connect with existing or planned recreational opportunities.
- LU-6.8 Oversight of Open Space.** Require that open space associated with future development that is intended to be preserved in perpetuity either be:
- 1) Retained in private ownership of the property owner or a third party with a restrictive easement that limits use of the land as appropriate; or
 - 2) Transferred into public ownership of an agency that manages preserved open space.
- The owner of the open space will be responsible for the maintenance and any necessary management unless those responsibilities are delegated through an adopted plan or agreement. Restrictive easements shall be dedicated to the County or a public agency (approved by the County) with responsibilities that correspond with the purpose of the open space. When transferred to a third party or public agency, a funding mechanism to support the future maintenance and management of the property should be established to the satisfaction of the County.
- LU-6.9 Development Conformance with Topography.** Require development to conform to the natural topography to limit grading; incorporate and not significantly alter the dominant physical characteristics of a site; and to utilize natural drainage and topography in conveying stormwater to the maximum extent practicable.
- LU-6.10 Protection from Hazards.** Require that development be located and designed to protect property and residents from the risks of natural and man-induced hazards.
- LU-6.11 Protection from Wildfires and Unmitigable Hazards.** Assign land uses and densities in a manner that minimizes development in extreme, very high and high fire threat areas or other unmitigable hazardous areas.
- LU-6.12 Flooding.** Document and annually review areas within floodways and 100- and 200-year floodplains to ensure areas subject to flooding are accurately mapped in accordance with AB 162 (enacted January 1, 2008). (See also Policy S-8.1)



Low Impact Development practices on a landscaped median in 4S Ranch

Additional goals and policies that relate to natural resources are contained in the Conservation and Open Space Element, while those related to natural hazards are in the Safety Element.

GOALS AND POLICIES

GOAL LU-7

Agricultural Conservation. A land use plan that retains and protects farming and agriculture as beneficial resources that contribute to the County's rural character.

Policies

LU-7.1 Agricultural Land Development. Protect agricultural lands with lower-density land use designations that support continued agricultural operations.



Agricultural lands in the Pauma Valley

LU-7.2 Parcel Size Reduction as Incentive for Agriculture. Allow for reductions in lot size for compatible development when tracts of existing historically agricultural land are preserved in conservation easements for continued agricultural use.

Refer to the Agricultural Resources section of the Conservation and Open Space Element for additional goals and policies.

GOAL LU-8

Aquifers and Groundwater Conservation. Sustainable aquifers and functional groundwater recharge areas.

Policies

LU-8.1 Density Relationship to Groundwater Sustainability. Require land use densities in groundwater dependent areas to be consistent with the long-term sustainability of groundwater supplies, except in the Borrego Valley.

LU-8.2 Groundwater Resources. Require development to identify adequate groundwater resources in groundwater dependent areas, as follows:

- In areas dependent on currently identified groundwater overdrafted basins, prohibit new development from exacerbating overdraft conditions. Encourage programs to alleviate overdraft conditions in Borrego Valley.
- In areas without current overdraft groundwater conditions, evaluate new groundwater-dependent development to assure a sustainable long-term supply of groundwater is available that will not adversely impact existing groundwater users.

A groundwater basin is considered in an overdraft condition when, during average conditions over a number of years, the amount of water being withdrawn from the basin exceeds the amount of water that recharges the basin.

LU-8.3 Groundwater-Dependent Habitat. Discourage development that would significantly draw down the groundwater table to the detriment of groundwater-dependent habitat.

LU-8.4 Program for Borrego Valley Aquifer. Support the Borrego Valley Water District with their program to slow the overdrafting and extend the life of the aquifer supporting the residents of the Borrego Valley.



CHAPTER 3 LAND USE ELEMENT

An aquifer is in overdraft condition when the amount of water being withdrawn (by pumping or by other means) exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions.

Refer to the Water Resources section of the Conservation and Open Space Element for additional groundwater-related goals and policies.

Villages and Town Centers

CONTEXT

Smart growth concepts focus growth in compact areas close to jobs, services, and public facilities to maximize the use of existing infrastructure and preserve open space and natural resources. The General Plan Land Use Map accommodates approximately 80 percent of the unincorporated County's population growth within the CWA boundary. The Village regional category, which allows the most intensive land uses in the unincorporated County, facilitates the use of compact development patterns.

Villages that contain a mix of land uses encourage strong neighborhoods and contribute to meeting a community's daily commercial, civic, and social needs. New development can facilitate the achievement of these objectives and enhance the vitality and livability of existing Villages. Such development is expected to be diverse considering the unique needs and character of each Village.

It is important that new development in Villages be compatible with and connects to its surrounding area. Under the General Plan land use designations, many of the County's Villages may realize a sizable amount of growth in the future years. Unchecked, growth and new development can easily transform a community. However, when planned and implemented wisely, growth can be beneficial to a community's identity, economy, and character. Compatibility should be directed through the Community Plan, where the community's character is defined in greater detail, and the Zoning Ordinance. Because Village development will occur as infill or redevelopment, compatibility takes on a greater scope, accounting for the immediately surrounding area as well as the overall character of the Village.

Connections are also important to support a Village that has vitality and mobility. These attributes allow components of a Village to interact and capitalize upon one another, thus improving economy, place, and the sense of a distinct and unified identity. This is achieved through interconnected street and pedestrian networks, the use of localized design standards, careful transitions between land uses, and the incorporation of pedestrian connections and public amenities within larger developments.

Town Centers are the hubs or cores of Villages and can be more than just an assemblage of high-intensity land uses. Ideally, they are active places where community members interact, contribute to the local economy, and enjoy the unique sense of place offered by each community. Development plans can facilitate these activities through the design of both public and private spaces. Major public facilities such as schools, libraries, community centers, and parks that are located in Town Centers often contribute to its identity and level of activity.

New residential development, whether infill or new neighborhoods, can complement adjacent Village residential neighborhoods through compatible site and building design and connected circulation networks.

GOALS AND POLICIES

Larger developments have greater ability to contribute to the Village with a mix of housing options and a range of community amenities and supporting uses, such as recreational facilities and, where appropriate, civic and neighborhood commercial uses.

New commercial and industrial uses are at least equally and often more important to enhancing Villages and contributing to their identity and viability. This is because they serve as attractors to residents and visitors, provide employment, and are often located near the core of the Village and have high visibility. In locating new commercial and industrial uses, care must be taken to avoid impacting existing business. Design will also require careful consideration to ensure compatibility.



Main Street in Julian provides a variety of land uses and building types

GOALS AND POLICIES

GOAL LU-9

Distinct Villages and Community Cores. Well-defined, well-planned, and well-developed community cores, such as Villages and Town Centers, that contribute to a community's identity and character.

Policies

- LU-9.1 Village and Community Core Planning.** Encourage the delineation of and development of more detailed planning direction for the character, design, uses, densities, and amenities of Village areas, Town Centers, and other community cores in Community Plans to assist in the future planning of residences, infrastructure, businesses, and civic uses.



A commercial center in Bonsall

- LU-9.2 Density Relationship to Environmental Setting.** Assign Village land use designations in a manner consistent with community character, and environmental constraints. In general, areas that contain more steep slopes or other environmental constraints should receive lower density designations. [See applicable community plan for possible relevant policies.]
- LU-9.3 Village and Community Core Guidelines and Regulations.** Support the development and implementation of design guidelines, Village-specific regulations for roads, parking, and noise, and other planning and regulatory mechanisms that recognize the unique operations and character of Villages, Town Centers, and transportation nodes. Ensure that new development be compatible with the overall scale and character of established neighborhoods.



CHAPTER 3 LAND USE ELEMENT

- LU-9.4 Infrastructure Serving Villages and Community Cores.** Prioritize infrastructure improvements and the provision of public facilities for Villages and community cores as sized for the intensity of development allowed by the Land Use Map.
- LU-9.5 Village Uses.** Encourage development of distinct areas within communities offering residents places to live, work, and shop, and neighborhoods that integrate a mix of uses and housing types.
- LU-9.6 Town Center Uses.** Locate commercial, office, civic, and higher-density residential land uses in the Town Centers of Villages or Rural Villages at transportation nodes. Exceptions to this pattern may be allowed for established industrial districts and secondary commercial districts or corridors.
- LU-9.7 Town Center Planning and Design.** Plan and guide the development of Town Centers and transportation nodes as the major focal point and activity node for Village areas. Utilize design guidelines to be compatible with the unique character of a community. Roadways, streetscapes, building facades, landscaping, and signage within the town center should be pedestrian oriented. Wherever possible, locate public facilities, such as schools, libraries, community centers, and parks in Town Centers and Villages.
- LU-9.8 Village Connectivity and Compatibility with Adjoining Areas.** Require new development within Villages to include road networks, pedestrian routes, and amenities that create or maintain connectivity; and site, building, and landscape design that is compatible with surrounding areas. [See applicable community plan for possible relevant policies.]
- LU-9.9 Residential Development Pattern.** Plan and support an efficient residential development pattern that enhances established neighborhoods or creates new neighborhoods in identified growth areas.
- LU-9.10 Internal Village Connectivity.** Require that new development in Village areas are integrated with existing neighborhoods by providing connected and continuous street, pathway, and recreational open space networks, including pedestrian and bike paths.
- LU-9.11 Integration of Natural Features in Villages.** Require the protection and integration of natural features, such as unique topography or streambeds, into Village projects.
- LU-9.12 Achieving Planned Densities in Villages.** In villages, encourage future residential development to achieve planned densities through multi-family, mixed use, and small-lot single-family projects that are compatible with the community character.



Residential areas surround commercial and office establishments, schools, and parks in Fallbrook

GOALS AND POLICIES

Semi-Rural/Rural Lands

CONTEXT

As they share many common goals and policies, the Semi-Rural and Rural Lands regional categories are combined under this section. Semi-Rural areas comprise the majority of unincorporated land within the CWA boundary and include low-density residential, agricultural, and recreation uses. These lands buffer and separate Village areas and are expected to develop in a manner consistent with their natural environment and rural character. Rural Lands are typically located outside of or between Semi-Rural areas and further define and separate the communities they surround.



Rural lands outside the village of Julian

The majority of unincorporated land outside the CWA Boundary is largely undeveloped, lacks infrastructure, and is thus designated as Rural Lands. A significant portion of these lands is in public ownership and is typically used for recreation or environmental preservation. Outside the CWA boundary, Semi-Rural lands typically reflect established communities.

The lower densities in the Semi-Rural and Rural Lands allow for reduced development pressures and greater flexibility in a manner that minimizes impacts to the environment. This can be accomplished by implementing policies that require all development in Semi-Rural and Rural Lands to protect and sustain ecosystems, topography, riparian corridors, rock formations, mature trees and other natural assets, and avoid natural hazards, such as flooding, steep slopes, and seismic instability.

Despite numerous constraints to agriculture in San Diego County, such as high water and land costs, the County has a robust agricultural economy. Agriculture contributes to the character of the County, and particularly Semi-Rural and Rural Lands, supplying County residents with local agricultural products, and contributing significantly to the local economy. A goal of these categories is the preservation of local agriculture, which includes a diverse mix of high value commodities and takes advantage of a long—in some cases year-round—growing season. Incompatibility of adjacent land uses can present yet another constraint to the viability of local agriculture. As residential and other potentially incompatible development occurs in traditionally agricultural areas, careful attention should be given to the compatibility of these nonagricultural uses and to site design techniques that would reduce or avoid potential conflicts. Goals and policies that pertain to agriculture are located in the conservation and Open Space Element (Chapter 5).

GOALS AND POLICIES

GOAL LU-10

Function of Semi-Rural and Rural Lands. Semi-Rural and Rural Lands that buffer communities, protect natural resources, foster agriculture, and accommodate unique rural communities.



Policies

LU-10.1 Residential Connectivity. Require residential development in Semi-Rural areas to be integrated with existing neighborhoods by providing connected and continuous street, pathway/trail, and recreational open space networks.

LU-10.2 Development—Environmental Resource Relationship. Require development in Semi-Rural and Rural areas to respect and conserve the unique natural features and rural character, and avoid sensitive or intact environmental resources and hazard areas.



Echo Valley in the Jamul Community Planning Area

LU-10.3 Village Boundaries. Use Semi-Rural and Rural land use designations to define the boundaries of Villages and Rural Land Use designations to serve as buffers between communities.

LU-10.4 Commercial and Industrial Development. Limit the establishment of commercial and industrial uses in Semi-Rural and Rural areas that are outside of Villages (including Rural Villages) to minimize vehicle trips and environmental impacts.

Commercial, Office, and Industrial Development

CONTEXT

While the Community Development Model and the General Plan Regional Categories directly relate to the ranges of intensity of the residential Land Use Designations, as shown on Table LU-1, there is less of a correlation to the nonresidential Land Use Designations (Commercial, Office Professional, and Industrial). As such, specific guidance is needed to ensure that nonresidential development is planned and occurs in a manner consistent with the Guiding Principles for the General Plan and the plans of each unincorporated community.

Commercial, office, and industrial uses are important to a community's identity and viability. They serve as attractors to residents and visitors, provide employment, and contribute to the economy. Commercial uses accommodate the retail and service needs of, and provide employment opportunities for, surrounding residents. Primary commercial areas, such as Town Centers, typically serve an entire Village and its surrounding rural residents. Land-intensive commercial activity will generally serve regional as well as local needs, and is best located at key intersections of multi-modal transportation corridors. There is also a need for smaller scale commercial uses in residential neighborhoods beyond the Village core to serve the convenience needs of residents in that area.

Typical Office Professional uses include office-oriented professional and administrative services and research and development activities. Large-scale office uses are typically clustered in campus-style office or industrial park settings, while smaller-scale office uses are typically located in mixed-use Village and Neighborhood Centers. The Village Core Mixed Use, neighborhood commercial, and General Commercial land use

GOALS AND POLICIES

designations all provide for this type of mixed-use office development. While, office development that requires large, continuous floor area may be accommodated in campus-style office parks under the Office Professional and Light Industrial land use designations, it is important that these developments not be isolated and separated by location design from adjoining land uses, resulting in a distinct island. Compatibility with the adjacent development and connections to vehicular and pedestrian circulation networks remain important.

Typical industrial uses include manufacturing, processing, assembly, wholesaling, and warehouse activities that normally require large indoor and outdoor areas for processing and storage. In the unincorporated County, these uses typically occur on large development sites or as clusters of smaller sites served by municipal infrastructure and with direct access to major transportation corridors. Industrial uses with adverse impacts such as noise, vibration, odor, and aesthetic impairment must be

carefully located and designed to avoid compatibility issues with adjacent land uses. Light industrial uses are considered compatible in pedestrian-oriented Village centers because they are similar in function and form to offices. Medium industrial uses are most compatible within Village boundaries but outside the pedestrian-oriented center and buffered from incompatible residential or commercial land uses.



The pedestrian-oriented Main Avenue in Fallbrook

GOALS AND POLICIES

GOAL LU-11

Commercial, Office, and Industrial Development. Commercial, office, and industrial development that is appropriately sited and designed to enhance the unique character of each unincorporated community and to minimize vehicle trip lengths.

Policies

- LU-11.1 Location and Connectivity.** Locate commercial, office, and industrial development in Village areas with high connectivity and accessibility from surrounding residential neighborhoods, whenever feasible.
- LU-11.2 Compatibility with Community Character.** Require that commercial, office, and industrial development be located, scaled, and designed to be compatible with the unique character of the community.



CHAPTER 3 LAND USE ELEMENT

- LU-11.3 Pedestrian-Oriented Commercial Centers.** Encourage the development of commercial centers in compact, walkable configurations in Village centers that locate parking in the rear or on the side of the parcel, use transparent storefronts with active retail street-fronting uses, minimize setbacks, and discourage "strip" commercial development. "Strip" commercial development consists of automobile-oriented commercial development with the buildings set back from the street to accommodate parking between the building and street.
- LU-11.4 Town Center Intensity and Vitality.** Encourage revitalization of Town Center areas to strengthen neighborhoods, expand local employment opportunities, and establish or enhance a sense of place.
- LU-11.5 Large-Format Retail Stores.** Allow large-format retail uses, typically referred to as "big box stores," only where the scale of the use and design is compatible with the surrounding areas. Large-format retail typically means retail stores with floor plans that are larger than 65,000 sq. ft.
- LU-11.6 Office Development.** Locate new office development complexes within Village areas where services are available, in proximity to housing, and along primary vehicular arterials (ideally with transit access) with internal vehicular and pedestrian linkages that integrate the new development into the multi-modal transportation network where feasible.
- LU-11.7 Office Development Compatibility with Adjoining Uses.** Require new office development, including office parks, to be compatible to the scale, design, site layout, and circulation patterns of adjacent existing or planned commercial and residential development.
- LU-11.8 Permitted Secondary Uses.** Provide a process where secondary land uses may be permitted when appropriate and compatible with the primary commercial, office, and light industrial uses, in order to better serve the daily needs of employees and to reduce the frequency of related automobile trips. This policy is not intended for high impact industrial uses.
- LU-11.9 Development Density and Scale Transitions.** Locate transitions of medium-intensity land uses or provide buffers between lower intensity uses, such as low-density residential districts and higher intensity development, such as commercial or industrial uses. Buffering may be accomplished through increased setbacks or other techniques such as grade differentials, walls, and/or landscaping but must be consistent with community design standards.
- LU-11.10 Integrity of Medium and High Impact Industrial Uses.** Protect designated Medium and High Impact Industrial areas from encroachment of incompatible land uses, such as residences, schools, or other uses that are sensitive to industrial impacts. The intent of this policy is to retain the ability to utilize industrially designated locations by reducing future development conflicts.
- LU-11.11 Industrial Compatibility with Adjoining Uses.** Require industrial land uses with outdoor activities or storage to provide a buffer from adjacent incompatible land uses (refer to Policy LU-11.9 for examples of buffering).

Community Services and Infrastructure

CONTEXT

Land uses in the County are supported by a diversity of public utilities and services. Among these are water supply, wastewater collection and treatment, solid waste management, schools, and libraries.

GOALS AND POLICIES

WATER SUPPLY

San Diego County is located in a semi-arid to arid desert climate with limited local water supplies, requiring that the majority of its water resources be imported. The County is not a purveyor of water and must rely on the San Diego County Water Authority (SDCWA) and its member agencies to provide the majority of water delivery to the region. Fifteen of the 24 current SDCWA member agencies provide water to the unincorporated areas of the County. An



Otay Reservoir

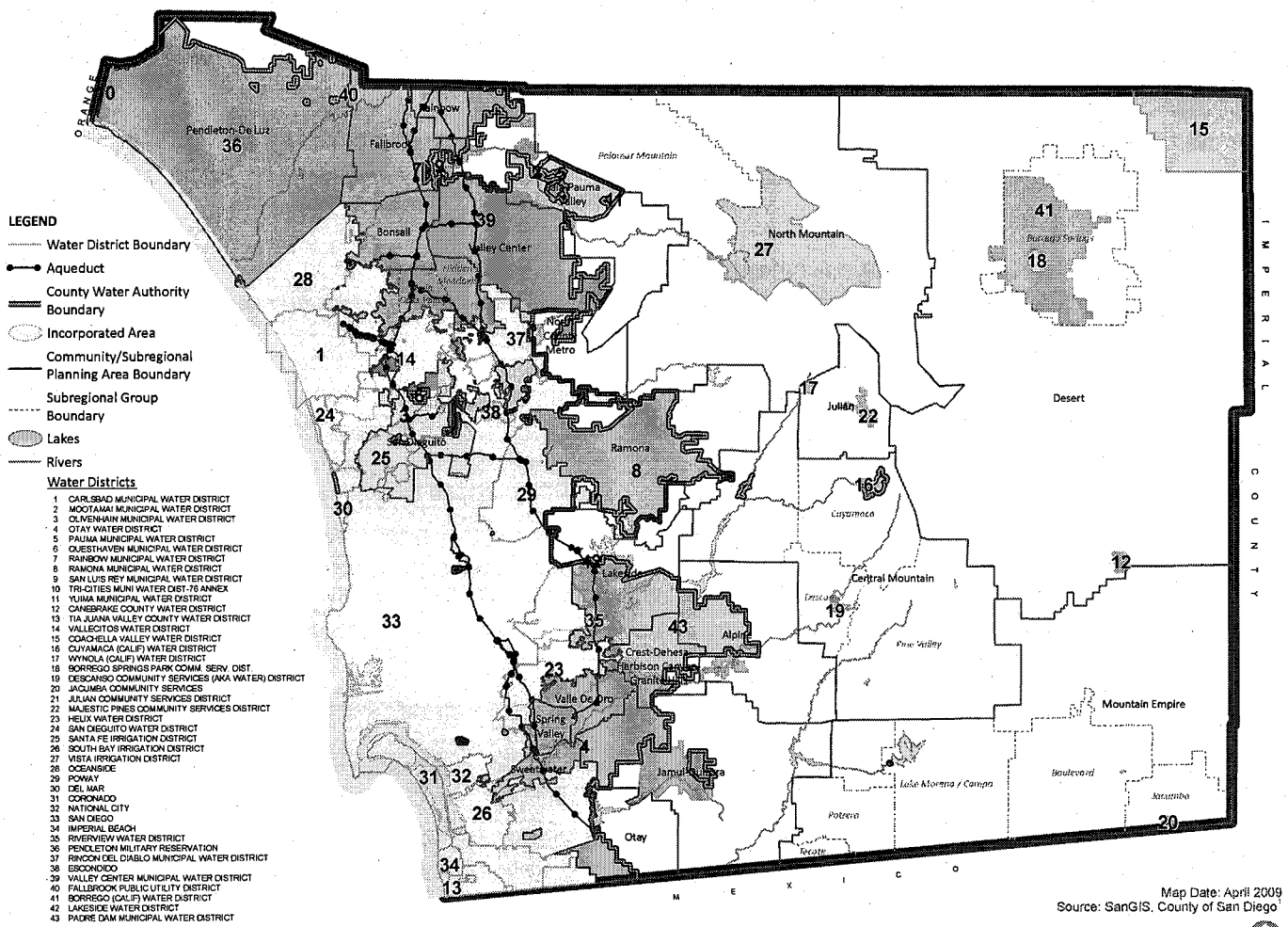
additional 14 independent special districts, along with private water systems, provide services to the unincorporated County. The water districts in the unincorporated County are shown on Figure LU-2 (Water Districts).

The City of San Diego owns and maintains seven drinking source water reservoirs in the County. While these reservoirs do not provide potable water for residents outside the city, they are used by County residents for recreation and provide valuable habitat.

The California Urban Water Management Planning Act requires that each urban water supplier, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually, shall prepare, update and adopt an (Urban Water Management Plan) UWMP at least once every five years on or before December 31, in years ending in five and zero. In the 2005 UWMPs, the Metropolitan water District (MWD), SDCWA and all 15 SDCWA member agencies that serve the unincorporated County determined that adequate water supplies would be available to serve existing service areas under normal water year, single dry water year, and multiple dry water year conditions through the year 2030. However, there are multiple issues related to the projections included in the 2005 UWMPs. Factors such as cutbacks in water importation supplies from MWD and SDCWA and the statewide drought have not have been accounted for in 2005 UWMP supply and demand projections.

In addition to the UWMP, which deals with long term planning, SDCWA's Board of Directors approved a Drought Management Plan (DMP) in 2006. The DMP provides potential actions that the SDCWA can take to minimize or avoid the impacts associated with supply shortage conditions due primarily to droughts. The DMP also contains a water supply allocation methodology to be used if the SDCWA is required to allocate supplies to its member agencies.

In August 2007, a U.S. District court decision was issued to protect the endangered Delta smelt (fish). This federal court ruling set operational limits on pumping in the Sacramento-San Joaquin Delta from December 2007 to June 2008 to protect the Delta smelt. As a result of this ruling, MWD is estimated to see as much as a 20 to 30 percent reduction in State Water Project supplies in 2008 and beyond. This means that local water agencies would have to rely on increased conservation, along with contingency and emergency sources of water, including local groundwater and storage supplies, to lessen direct impacts on water availability for their customers.



WATER DISTRICTS

San Diego County General Plan

Map Date: April 2009
Source: SanGIS, County of San Diego

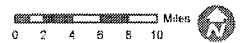
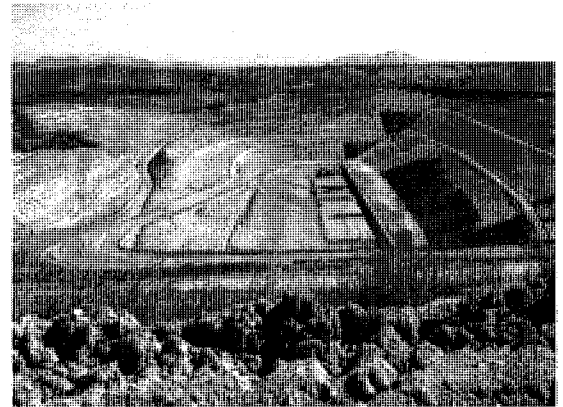


Figure LU-2

GOALS AND POLICIES

Additionally, after a record dry spring that dramatically curtailed snow runoff from the Sierra Nevada Mountains, Governor Schwarzenegger declared an official statewide drought on June 4, 2008. Following the Governor's action, the MWD board of directors issued a Water Supply Alert for its six-county service area, urging local jurisdictions to adopt and implement water conservation ordinances and to significantly increase efforts and programs to conserve water.

The Colorado River, the other major source of imported supplies for MWD, has experienced drought conditions for eight of the last nine years. The Colorado River provides water to more than 31 million people in seventeen western states. Since the drought in the late 1980s and early 1990s, MWD enacted a plan to improve water supplies during dry conditions. The Integrated Resources Plan (2004) called for increasing MWD's ability to store wet-year surplus supplies from the Colorado River and Northern California's Sacramento-San Joaquin Delta. In 2007, enough water in reserve was available to help MWD withstand up to three successive dry years. The federal



Otay County Landfill

court decision on the Delta smelt reduces MWD's ability to replenish reserves in wet years and prolonged dry conditions in California continue to draw on the reserves. As a result the, MWD's near-term strategy is to lower demand and stretch the reserve supplies as much as possible.

Additionally, climate changes due to global warming also create new uncertainties that significantly affect California's water resources and lessen the reliability of 2005 UWMPs. All 2005 UWMPs include a drought management or shortage contingency analysis section, which identifies how the agency will manage shortages. However, these UWMPs do not account for the severity or longevity of the above-mentioned difficulties in providing enough supply for the region's demand. In preparing 2010 UWMPs, the SDCWA and its water districts will need to account for these issues and will likely place more emphasis on conservation, water recycling, and expanding local supplies through methods such as seawater desalination, groundwater, surface water, transfers, and imported supplies. Development of the diverse sources of water will aid in reducing the SDCWA's purchases of imported supplies from the MWD. Groundwater is the primary source of supply for the special water districts and private water systems that serve the groundwater-dependent unincorporated areas. In addition, many areas of the County are dependent on individual wells and are not served by water agencies. The Land Use Map allows limited development in these areas. In California, individual groundwater users are typically not regulated in regard to the amount of groundwater they can use nor does the County typically restrict an individual's use. However, the County can deny discretionary permits if the proposed groundwater resources are not sufficient for the proposed development. For permits with ongoing conditions, the County can require limitations or conditions on the amount of groundwater that can be withdrawn.



SOLID WASTE

Solid waste management has been recognized as an important regional issue in San Diego County because of limited landfill capacity, urban encroachment, and environmental concerns reducing potential facility expansions and replacement sites, environmental regulations, and the increased cost of developing and operating waste management facilities. Historically, the primary method of disposing of solid waste has been through the use of landfills. Since the early 1990s, there has been a growing emphasis to reduce the amount of solid waste being disposed of in landfills through integration of recycling and source reduction. There are seven active landfills in the San Diego region that serve both incorporated and unincorporated areas. The landfills currently operating in the County for public use are either privately owned and operated or are owned and operated by another local jurisdiction. There is sufficient landfill space for thirty years considering current landfill expansions, and proposed new landfills. However there is insufficient infrastructure to support the traffic flow to and from the landfills resulting in daily and annual permitted tonnage restrictions. Current plans for expansion of existing landfills and new landfills would add 179 million tons of capacity. The San Diego County Integrated Waste Management Plan Siting Element analysis (2005) determined that if the County would recycle at a rate of 75 percent, which complies with State mandates for integrated solid waste management, compared to the present 50 percent, there would be no need for additional landfills in the County, including the proposed Gregory Canyon and Campo landfills.

EDUCATION

The provision of educational facilities and services are mandated by the State Department of Education and administered by the San Diego County Board of Education and the San Diego County Office of Education, which is a public agency with land use authority that is separate from the County of San Diego. The County Offices of Education and the San Diego County Board of Education provide a support infrastructure for local schools and districts while acknowledging each school board's responsibility to represent and serve their community. The day-to-day development of facilities and delivery of instruction is generally the responsibility of the County's 42 local school districts. Student populations in the unincorporated areas of the County have generally experienced steady growth rates depending on the particular community or area that the school facility is located. Because the County of San Diego does not have jurisdiction over the land use decisions of public schools, its responsibility for school facilities is limited to review and comment on projects for proposed schools.

WASTEWATER

The majority of sewage treatment and disposal in the unincorporated areas of San Diego County is accomplished by one of the following three methods: (1) regional systems maintained by public water or sewer districts; (2) small wastewater treatment facilities operated by independent districts or the County; and (3) on-site subsurface sewage disposal (septic) systems. The method of treatment and disposal often depends on the district's location. Generally, those districts located in the proximity of the City of San Diego are members of the San Diego Metropolitan Sewerage System (Metro) and use its system for treatment and effluent disposal. A number of agencies also use a combination of the Metro system and inland treatment and disposal. Those districts located near the coastal areas provide effluent disposal through the use of an ocean outfall. Those districts located inland (a majority of the unincorporated areas of the County) provide sewage treatment and disposal through reuse, spray fields, evaporation, and other techniques.

GOALS AND POLICIES

The Department of Public Works (DPW) Wastewater Management Section (WWM) is responsible for maintaining sewer lines, pump stations, force mains and several treatment plants for the unincorporated areas of Alpine, Julian, Lakeside, Spring Valley, Pine Valley, Campo, East Otay Mesa, and the Winter Gardens area. Wastewater flows originating within the communities of Alpine, Lakeside, Winter Gardens, Spring Valley, and East Otay Mesa are transmitted to the City of San Diego metro system for treatment and disposal. The remaining communities of Julian, Pine Valley, and Campo utilize “inland” treatment and disposal systems.

TELECOMMUNICATIONS

Telecommunications services are offered to county residents by a diversity of providers. These include Time Warner and Cox Communications for cable television and digital services; AT&T for standard landline telephone; Verizon, Sprint, Cingular/AT&T, Nextel, Cricket, and T-Mobile for cell phone; and Vonage and Skype for voice over Internet protocol. Due to the dispersed and low-density pattern of development in the County, particularly in its eastern-most reaches, some telecommunication services are not available throughout the entirety of the area.

ISSUES

The following are the key issues related to community services and infrastructure in the unincorporated County:

- Coordination of service and infrastructure can be difficult in the unincorporated areas that are served by numerous other entities.
- The geographic extent of the unincorporated County precludes the ability to provide the same level of services and infrastructure to all of its lands.
- Limited population density and/or access to some areas of the unincorporated County also result in both physical and fiscal challenges to providing services.
- Maintenance and enhancement of public infrastructure is important to the well-being of existing communities. Many existing communities include basic infrastructure such as roads, water and sewer, but could benefit from enhancements such as pathways, trails, landscaping, and better connected roads.
- As development occurs, it is important to existing communities that this development provides for adequate services to meet its own needs without adversely affecting the existing residents.
- Some community services, such as libraries and community centers, may contribute to defining a community's identity, location, and character.

These and other issues relevant to community services and infrastructure in the unincorporated County area are addressed in this General Plan. As previously stated, additional goals and policies on some specific services or infrastructure can be found in other elements of the General Plan (refer to the Mobility Element for transportation-related infrastructure, the Conservation and Open Space Element for recreational facilities, and the Safety Element for emergency services and law enforcement). The following goals and policies either pertain to those issues not covered by other elements or are more general.



GOALS AND POLICIES

GOAL LU-12

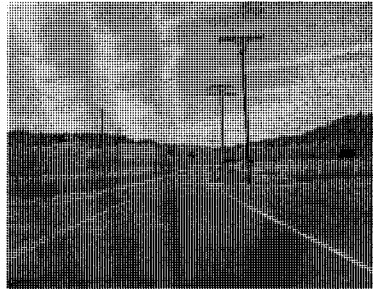
Infrastructure and Services Supporting Development. Adequate and sustainable infrastructure, public facilities, and essential services that meet community needs and are provided concurrent with growth and development.

Policies

LU-12.1 Concurrency of Infrastructure and Services with Development. Require the provision of infrastructure, facilities, and services needed by new development prior to that development, either directly or through fees. Where appropriate, the construction of infrastructure and facilities may be phased to coincide with project phasing.

In addition to utilities, roads, bicycle and pedestrian facilities, and education, police, and fire services, transit-oriented infrastructure, such as bus stops, bus benches, turnouts, etc, should be provided, where appropriate.

LU-12.2 Maintenance of Adequate Services. Require development to mitigate significant impacts to existing service levels of public facilities or services for existing residents and businesses. Provide improvements for Mobility Element roads in accordance with the Mobility Element Network Appendix matrices, which may result in ultimate build-out conditions that achieve an improved LOS but do not achieve a LOS of D or better.



LU-12.3 Infrastructure and Services Compatibility. Provide public facilities and services that are sensitive to the environment with characteristics of the unincorporated communities. Encourage the collocation of infrastructure facilities, where appropriate.

Public services and facilities in Village areas are expected to differ from those in rural lands. Development standards in the Implementation Plan, Zoning Ordinance, and community-specific planning documents may reflect this 'context-sensitive' approach.

LU-12.4 Planning for Compatibility. Plan and site infrastructure for public utilities and public facilities in a manner compatible with community character, minimize visual and environmental impacts, and whenever feasible, locate any facilities and supporting infrastructure outside preserve areas. Require context sensitive Mobility Element road design that is compatible with community character and minimizes visual and environmental impacts; for Mobility Element roads identified in Table M-4, an LOS D or better may not be achieved.

GOALS AND POLICIES

GOAL LU-13

Adequate Water Quality, Supply, and Protection. A balanced and regionally integrated water management approach to ensure the long-term viability of San Diego County's water quality and supply.

Policies

LU-13.1 Adequacy of Water Supply. Coordinate water infrastructure planning with land use planning to maintain an acceptable availability of a high quality sustainable water supply. Ensure that new development includes both indoor and outdoor water conservation measures to reduce demand.



*Olivehain Reservoir in the Elfin Forest
Recreational Preserve*

LU-13.2 Commitment of Water Supply. Require new development to identify adequate water resources, in accordance with State law, to support the development prior to approval.

GOAL LU-14

Adequate Wastewater Facilities. Adequate wastewater disposal that addresses potential hazards to human health and the environment.

Policies

LU-14.1 Wastewater Facility Plans. Coordinate with wastewater agencies and districts during the preparation or update of wastewater facility master plans and/or capital improvement plans to provide adequate capacity and assure consistency with the County's land use plans.

LU-14.2 Wastewater Disposal. Require that development provide for the adequate disposal of wastewater concurrent with the development and that the infrastructure is designed and sized appropriately to meet reasonably expected demands.

LU-14.3 Wastewater Treatment Facilities. Require wastewater treatment facilities serving more than one private property owner to be operated and maintained by a public agency. Coordinate the planning and design of such facilities with the appropriate agency to be consistent with applicable sewer master plans.

LU-14.4 Sewer Facilities. Prohibit sewer facilities that would induce unplanned growth. Require sewer systems to be planned, developed, and sized to serve the land use pattern and densities depicted on the Land Use Map. Sewer systems and services shall not be extended beyond either Village boundaries or extant Urban Limit Lines, whichever is more restrictive, except:

- When necessary for public health, safety, or welfare;
- When within existing sewer district boundaries;
- When necessary for a conservation subdivision adjacent to existing sewer facilities; or
- Where specifically allowed in the community plan.

LU-14.5 Alternate Sewage Disposal Systems. Support the use of alternative on-site sewage disposal systems when conventional systems are not feasible and in conformance with State guidelines and regulations.



GOAL LU-15

Adequate Wireless Communication Facilities. Wireless telecommunication facilities that utilize state-of-the-art techniques to minimize impacts to communities and the environment.

Policies

- LU-15.1 Telecommunication Facilities Compatibility with Setting.** Require that wireless telecommunication facilities be sited and designed to minimize visual impacts, adverse impacts to the natural environment, and are compatible with existing development and community character.
- LU-15.2 Co-Location of Telecommunication Facilities.** Encourage wireless telecommunication service providers to co-locate their facilities whenever appropriate, consistent with the Zoning Ordinance. *[See applicable community plan for possible relevant policies.]*

GOAL LU-16

Appropriately Sited Waste Management Facilities. Solid waste management facilities that are appropriately located and sited in a manner that minimizes environmental impacts and potential conflicts from incompatible land uses, while facilitating recycling and resource recovery activities.

Policies

- LU-16.1 Location of Waste Management Facilities.** Site new solid waste management facilities identified in the San Diego County Integrated Waste Management Plan, in a manner that minimizes environmental impacts and prevents groundwater degradation, and in accordance with applicable local land use policies.
- LU-16.2 Integrity of Waste Management Facilities.** Avoid encroachment of incompatible land uses upon solid waste facilities in order to minimize or avoid potential conflicts.
- LU-16.3 New Waste Management Facilities.** Encourage the establishment of additional recycling and resource recovery facilities in areas with Industrial land use designations or other appropriate areas based on the type of recycling. *For example, some agricultural areas may be appropriate for management or recycling of agricultural wastes (composting).*

GOAL LU-17

Adequate Education. Quality schools that enhance our communities and mitigate for their impacts.

Policies

- LU-17.1 Planning for Schools.** Encourage school districts to consider the population distribution as shown on the Land Use Map when planning for new school facilities.
- LU-17.2 Compatibility of Schools with Adjoining Uses.** Encourage school districts to minimize conflicts between schools and adjacent land uses through appropriate siting and adequate mitigation, addressing such issues as student drop-off/pick up locations, parking access, and security.

GOALS AND POLICIES

- LU-17.3 Priority School Locations.** Encourage school districts to locate schools within Village or Rural Village areas wherever possible and site and design them in a manner that provides the maximum opportunity for students to walk or bicycle to school.
- LU-17.4 Avoidance of Hazards.** Assist school districts with locating school facilities away from fault zones, flood or dam inundation zones, and hazardous materials storage areas in conformance with State statutes.

GOAL LU-18

Adequate Civic Uses. Civic uses that enhance community centers and places.

Policies

- LU-18.1 Compatibility of Civic Uses with Community Character.** Locate and design Civic uses and services to assure compatibility with the character of the community and adjoining uses, which pose limited adverse effects. Such uses may include libraries, meeting centers, and small swap meets, farmers markets, or other community gatherings.
- LU-18.2 Co-Location of Civic Uses.** Encourage the co-location of civic uses such as County library facilities, community centers, parks, and schools. To encourage access by all segments of the population, civic uses should be accessible by transit whenever possible.

Food Miles – practical steps for New Zealand exporters

Ann Smith, Cerasela Stancu and Stu McKenzie

Discussion about food miles has recently escalated, with increased attention given to the implications of climate change. The distance to market for New Zealand exporters cannot be avoided. Repositioning New Zealand exports as a sustainable option for importing countries represents an opportunity rather than a cost. This briefing paper describes options available to those exporters who believe the food miles issue represents either a threat or an opportunity for their business. It describes practical actions that can be taken to reduce greenhouse gas emissions due to production and distribution.

Food miles or climate change – what is the real issue?

Food miles as a term was first used by the United Kingdom's SAFE Alliance in 1994 to highlight the environmental and social impacts caused by the increasing distances travelled by food. Simply defined as the distance in kilometres or miles that food travels from farm gate to consumer¹, it is easily understood and emotive. It has been adopted by local food movements in several countries and used to promote the growth of initiatives such as farmers' markets.

Whether or not the term food miles is a valid measure, it is being used by overseas markets in their purchasing decisions³ and beginning to appear in government policies.⁴ It is unlikely that the issue will disappear. Indeed, other types of products are also being targeted in the same way with calls for consumers to be aware of flower miles⁵ and clothes miles.⁶

Recent media coverage of the food miles issue has focused on the carbon footprint and hence climate change impacts of transporting food over long distances. In the context of general recognition that greenhouse gas (GHG) emissions⁸ from human activities need to be reduced to reverse the impacts of climate change, "foodmiles" is being used as a surrogate measure⁹ for the GHG emissions due to food transport. The Stern Review¹⁰ calls for urgent action to reduce emissions globally by at least 60% by 2050 and is the first study to clarify the economic impacts of continuing on a "business as usual" trajectory.

Imagine how shocked I was to see onions from New Zealand! Onions are grown in Western Europe for most of the year, so why is it necessary to fly them over 12,000 miles to stock a supermarket in this country?

Paul Willis, 2004²

Given the market share of the supermarkets, it is reasonable to explore what more they can do to 'edit out' unnecessary food miles, packaging and waste, and to prioritise more seasonal produce. ... DEFRA should work to reduce the climate impacts of meat and dairy, by working with retailers, public procurers and the UK livestock sector to develop roadmaps by 2007 for a transition to a more localised supply chain of extensively farmed meat and dairy products.

Sustainable Consumption Round Table, 2006⁷

1 Paxton A (1994). *The Food Miles Report: The Dangers of Long Distance Food Transport*. The SAFE Alliance, London.

2 Willis P (2004). *Food Miles*. Worthing Borough Council. www.worthing.gov.uk

3 Lorek S, Spangenberg JH (2001). *Environmentally Sustainable Household Consumption*. Wuppertal Papers No 117. Wuppertal Institute for Climate, Environment and Energy, Wuppertal.

4 Department for the Environment Food and Rural Affairs (2006). *Food Industry Sustainability Strategy*. DEFRA, London.

5 Hargreaves V (2003). Say it with flowers. *Ecologistonline*. See www.theecologist.org/

6 Purvis A (2006). Greening the catwalk: fast fashion, heavy load. *Green Futures*, Issue 60.

7 Sustainable Consumption Round Table (2006). *I Will if You Will: Towards Sustainable Consumption*. National Consumer Council and Sustainable Development Commission, London.

8 There are six greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexa fluoride) and for reporting purposes they are converted to carbon dioxide (CO₂) equivalent emissions using internationally accepted conversion factors.

9 Pirog R (2004). Food miles: a simple metaphor to contrast local and global food systems. Hunger and Environmental Nutrition Dietetic Practice Group, Summer 2004. American Dietetic Association.

10 Stern S (2006). *The Stern Review: The Economics of Climate Change*. HM Treasury, London. See 13.2 The need for strong and urgent action.

To stimulate further action to reduce GHG emissions in the transport sector, the European Union (EU) has agreed to bring aviation into the EU Emissions Trading Scheme¹¹, thus setting a cap on airline emissions. All domestic and foreign flights within the EU will be covered from 2011 and all international flights to and from EU airports from 2012. The EU is also exploring policy options to reduce emissions from shipping.¹² Although maritime transport is far more fuel efficient than air freight, overall emissions are rising due to increased volumes of sea freight.¹³ The implications for exporters is a potential reduction in access to overseas markets due to higher costs, carbon taxes based on freight tonnage and higher landing fees.¹⁴

In reality, the food miles debate is about more than GHG emissions. It is part of a wider debate about globalisation versus localisation, and about sustainable systems of production and consumption. Accusations of protectionism by exporting countries are not helpful in this debate, as most people "share the common human inclination to support their own local community ahead of outsiders".¹⁶ In New Zealand, this is recognised through the Buy New Zealand Made and proposed Buy Kiwi Made programmes.

From an economic standpoint, we do need to be prepared for a future in which consumer preferences may shift towards low-carbon goods and services. It's not difficult to imagine the "food miles" campaign ... extending beyond a focus on Anchor butter, to the carbon footprint of any New Zealand produce.... Firms are going to have to think about how products are marketed and differentiated in response to a potential change in consumer preferences....

John Whitehead, Secretary to the Treasury, 2006¹⁵

New Zealand exporters need to develop a proactive strategy to put food miles in an appropriate context, i.e. in the context of the significance of environmental impacts along the whole value chain, including transport to market. As we subsequently describe, there is a range of practical measures producers and exporters can take to reinforce the "clean green" New Zealand brand, reduce emissions, gain cost savings, maintain access to overseas markets, and add value to export products.

Redefining food miles – a sustainable development perspective

It is widely acknowledged that food miles is not an adequate measure for the environmental impacts associated with bringing food to market.¹⁷ Indeed, some people have questioned whether a reduction in food miles does lead to more sustainable foods and farming systems.¹⁸ Instead, it is important to consider the interrelated economic, social and environmental aspects of food systems, i.e. to view the food miles debate from a sustainable development perspective. It is then possible to discuss some of the advantages, as well as disadvantages, of consuming imported foods; examples include the health benefits of imported fresh foods at certain times of the year, strengthened cultural links with other countries, and supporting the economies of developing countries.

A sustainable development perspective also requires a life cycle approach to products. Figure 1 shows that a life cycle approach includes consideration of the upstream production of materials, manufacturing, and downstream distribution of products including export to overseas markets. To address overall environmental impacts, such as climate change, all relevant inputs and outputs through this life cycle must be considered, including transport. In the case of climate change, relevant inputs and outputs are direct emission sources plus any indirect sources considered to be material.¹⁹

11 European Commission (2006). Climate change: Commission proposes bringing air transport into EU Emissions Trading Scheme. *Europa Rapid Press Releases* IP/06/1862, December 20.

12 Harvey F (2005). Brussels targets CO₂ emissions in maritime sector. *Financial Times*, November 21.

13 Wit R, Kampman B, Boon B et al (2004). *Climate Impacts from International Aviation and Shipping: State-of-the-art on Climatic Impacts, Allocation and Mitigation Policies*. Report for the Netherlands Research Programme on Climatic Change, Scientific assessments and policy analysis (NRPCC). CE, Delft. See 2.3 Marine.

14 Stern S (2006). *The Stern Review: The Economics of Climate Change*. HM Treasury, London. See 22.8 Interactions with the international trade regime.

15 Whitehead J (2006). *Beyond 2010: Preparing for Tomorrow's Economic Challenges Today*. Simpson Grierson Policy Maker Seminar Series, Wellington.

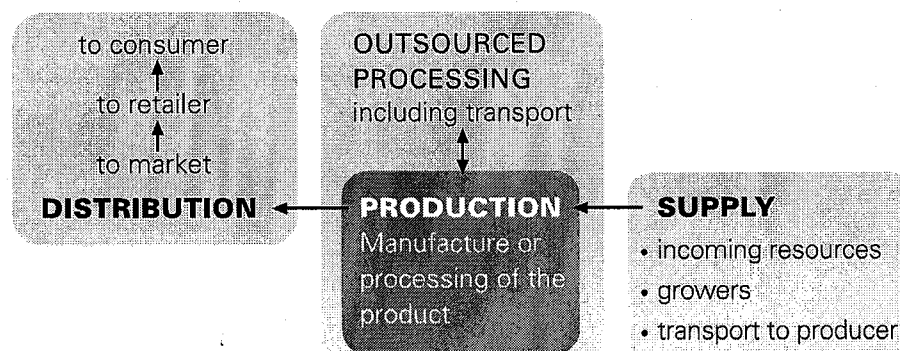
16 Quote from Buy New Zealand Made. See www.buynz.org.nz/about/

17 Smith A, Watkiss P, Tweddle G et al. (2005). The validity of food miles as an indicator of sustainable development: final report produced for DEFRA. *Report number ED50254*, Issue 7. AEA Technology, Didcot, Oxfordshire.

18 Hinrichs CC (2003). The practice and politics of food system localization. *Journal of Rural Studies* 19, 33–45.

19 An emissions source is material if: 1) its cumulative total is a significant proportion of total emissions; 2) it is important to stakeholders; 3) opportunities are available to reduce those emissions.

Figure 1: Emissions sources showing direct (production) and indirect (supply, outsourced processing, distribution) impacts along the whole value chain including transport (indicated by the arrows).



Once direct emissions due to production and transport have been addressed, a producer can in turn encourage and assist its suppliers and contractors to take action to reduce their emissions. Although transport to market is often at the buyer's expense, and therefore an indirect impact, the exporter is expected to cover any associated risks and these may come to include mitigation of emissions.²⁰ Whether these emissions are material will depend on consumer perceptions and the policies of the retailer.

Emissions caused by transport to and from ports are often overlooked and may be more significant than for port-to-port transport.²¹ Whether these emissions are material to the exporter or the retailer will depend on consumer perceptions and the policies of the retailer. Research has shown that the environmental impacts of both maritime and air freight for imports into the United Kingdom are trivial when compared with domestic transport, especially when transport of food to the home and to the landfill are accounted for.²¹ Even though port-to-port emissions may be proportionally very low, they still need to be included in the overall carbon footprint as these emissions are material to consumers and the general public as evidenced by the current food miles discussion.

Measuring the impacts of transport – an equal basis for comparison

Measuring the environmental impacts of bringing food to market is complex. Distance travelled is not an accurate measure of environmental impact. For example, the fuel efficiency, and hence GHG emissions, for a vehicle is dependent on factors such as the type of vehicle, its age, the type of fuel used, maintenance and driver behaviour. Driver training, vehicle specification and transport logistics have the greatest influence on fuel efficiency.²²

Maritime transport of goods over identical distances will have more or less GHG emissions depending on:

- the type of transport
- the type of fuel used
- weather conditions during transport
- weight load factor
- whether the produce is held at ambient temperature, cooled or chilled
- other operating conditions and storage requirements during transport.

International measures of freight emissions are generally based on freight tonnage and distance (tonne-kilometres); however, emissions factors need to be based on kilometric performance and factors such as those listed above.²³

The distance to market may be only a small fraction of the total environmental impact because:

- some of the ingredients may come from one or more other countries
- some of the processing steps may take place in other countries.

²⁰ Stern S (2006). *The Stern Review: The Economics of Climate Change*. HM Treasury, London. See 22.8 Interactions with the international trade regime.

²¹ Pretty JN, Ball AS, Land T et al (2006). Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food Policy* 30, 1–19.

²² Coyle M, Whiteing AE, Murray W (2002). *Fuel Saving Interventions: Facts and Fiction*. Transport and Logistics Research Unit, University of Huddersfield.

²³ Kolb A, Wacker M (1995). Calculation of energy consumption and pollutant emissions on freight transport routes. *The Science of the Total Environment* 169, 283–288.

More importantly, perhaps we should ask whether the proposed alternatives to imported foods are preferable. If locally sourced food is to be made available out of season, then there will be further GHG emissions due to additional energy needed to provide lighting, heating, water and nutrition. Growing exotic crops near consumer markets may require even more energy and resources. For example, efficient production methods in season in New Zealand may result in less overall GHG emissions even when including distance travelled to market.²⁴

Mitigating climate change impacts – taking proactive action

With respect to climate change, the Stern Review²⁵ emphasises that the longer action is delayed, the higher the costs and penalties. There are, however, many practical measures and techniques that can be adopted now to mitigate production and transport emissions.

If exporters see climate change as a major strategic issue, before taking action they first need to increase their understanding and respond to markets and customers' positions on climate change. Customers' environmental concerns may be obvious from supply chain questionnaires or corporate sustainability reports. Industry organisations or sector bodies may offer guidance on environmental best practice.

There are many environmental improvement schemes that producers can join and some of these offer third party assessment allowing the use of certified brands and seals of approval on products – eco-labelling.²⁶ Eco-labels are important tools for communicating to the market and consumers the environmental attributes of the product including production practices. Other overseas countries are also being targeted by those concerned about food miles. The standards and labels being used by peers and competitors may indicate how they are responding to these issues.

While you might feel virtuous that your organic blueberry has reduced the amount of chemicals flowing into the world's soil and waterways, you could be disappointed if you realise it's flown thousands of kilometres from Chile on a carbon dioxide-emitting aeroplane.

Sarah White, 2004²⁷

The whole concept of food miles is really getting to me – I don't want my apples airlifted from South America or brought over on the Eurostar from France. I could pretend that I'm environmentally offended but in truth I'm just jealous – I don't like my fruit to be better-travelled than I am.

Susan Grossey, 2006²⁸

When faced with food miles as an issue, we propose that comparisons are made with goods from overseas countries on the basis of the carbon footprint for the product life cycle, taking into account production and distribution including seasonal differences.

Three practical steps (see Figure 2) can then be taken:

- The first step is to MEASURE emissions. This involves identification of all direct and indirect sources of GHG emissions that are considered material, i.e. including those that are significant as a proportion of total emissions, important to stakeholders, and those emissions that can be reduced easily.
- The second step is to MANAGE or reduce emissions. This involves identifying and implementing opportunities to reduce emissions and reporting on progress. Simple calculators and guidance are available for small businesses to measure their GHG emissions. Assistance such as energy audits may be available through various government programmes.²⁹ For larger businesses with more complex production activities, more sophisticated software tools and external expertise may be needed.

²⁴ Saunders C, Barber A, Taylor G (2006). *Food Miles: Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry*. University of Lincoln.

²⁵ Stern S (2006). *The Stern Review: The Economics of Climate Change*. HM Treasury, London. See 5.5 Large-scale impacts and systemic shocks.

²⁶ Smith A, Stancu S (2006). *Ecolabels: a short guide for New Zealand producers*. *Business & Sustainability Series*, Briefing Paper 2, Landcare Research, Lincoln.

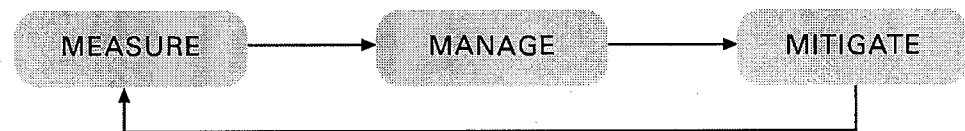
²⁷ White S (2004). *Going organic*. *TheSite.org*. See www.thesite.org

²⁸ Grossey S (2006). *Flying apples and carbon footprints*. *Cambridge Evening News*, 16 October.

²⁹ For example the Energy Efficiency and Conservation Authority, EECA. See www.eeca.govt.nz

- The last step is to MITIGATE or offset the remaining unavoidable emissions. This can be done through the purchase of carbon credits. A carbon credit³⁰ is equivalent to one tonne of CO₂ emissions that has been sequestered in a forest sink project, saved through an energy efficiency project, or avoided through alternative energy generation, e.g., windfarms, landfill gas or biofuels.

Figure 2: Three practical steps for reducing emissions and gaining carbon neutral status



Depending on company expectations or the demands of customers, it may be necessary to gain third-party endorsement for actions taken to reduce emissions. Stakeholders will be concerned about the credibility and integrity of environmental claims³¹; in particular, that significant emissions have been identified, that remaining emissions have been tested for materiality, that reliable data have been used to produce the emissions profile, and that a reputable third party has undertaken the assessment. Calculators and software tools for preparing carbon footprints or emissions profiles should be based on standards for GHG measurement and reporting such as the Greenhouse Gas Protocol³² and ISO 14064.³³

In turn, it is wise to check the credibility and integrity of the carbon credits purchased. Carbon credits generated through forest sink projects (e.g., Permanent Forests Sink Initiative³⁴) and non-forest projects (e.g., Projects to Reduce Emissions³⁵) should be third-party verified. Internationally recognised endorsement is available for non-forest projects through the World Wide Fund for Nature (WWF) Gold Standard³⁶ scheme. The type of credit chosen may bring added value because it is co-related to other issues such as community involvement, conservation, biodiversity, or watershed protection.

Environmental credentials – building on “clean green” New Zealand

The “clean green” New Zealand image has helped build the reputation of New Zealand products in overseas markets as environmentally responsible. When energy intensity is compared for a range of food products, research shows that New Zealand production is more efficient than for the same products produced in the UK.³⁷ However, as pressure increases on overseas retailers and buyers to address the environmental risks associated with their supply chains, producers will face more demands to implement standards and meet specific certification requirements that verify environmental claims.

Proactive producers have been building on their New Zealand identity by taking their products through both home-grown and international certification processes to strengthen their position in these markets. Research is needed to evaluate the cost effectiveness of these environmental standards for New Zealand products in international markets. It is important to exporters that domestic standards and brands gain international recognition. There is a role for the New Zealand government to endorse and promote domestic credentials where they demonstrably add credibility and integrity to products.

³⁰The carbon credits held on national registries are third-party verified Kyoto-compliant offset units. They meet rules set by the Kyoto Protocol that require the projects generating the emissions to be Additional or beyond business as usual, an Equivalent amount of CO₂ must be sequestered, saved or avoided to the amount offset, and there must be minimal Leakage or other unaccounted emissions generated by the project. The producers of voluntary or “grey market” carbon credits set their own rules but they are generally consistent with the Kyoto Protocol.

³¹Brignall M (2006). ASA clamps down on companies' green claims. *The Guardian*, Wednesday October 11.

³²World Business Council for Sustainable Development and World Resources Institute (1998). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*. WBCSD, Geneva.

³³International Organization for Standardization (2006). *ISO 14064-1:2006, Greenhouse Gases – Part 1: Specification with Guidance at the Organization Level for the Quantification and Reporting of Greenhouse Gas Emissions and Removals*.

³⁴See www.maf.govt.nz/forestry/pfsi/

³⁵See www.climatechange.govt.nz/policy-initiatives/projects/

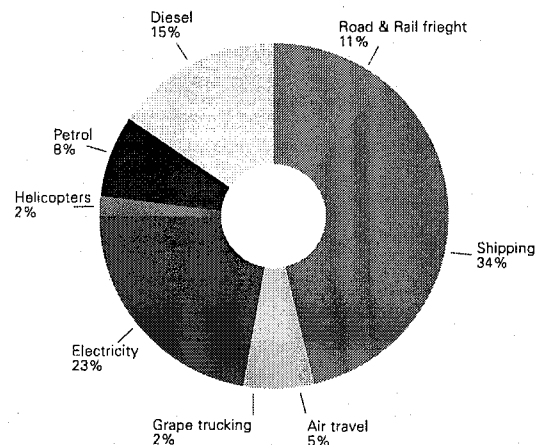
³⁶World Wide Fund for Nature (2002). *Gold Standard for Kyoto Projects*. WWF Factsheet. WWF, Gland.

³⁷Saunders C, Barber A, Taylor G (2006). *Food Miles: Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry*. University of Lincoln.

The New Zealand Wine Company (NZWC) has gained both Sustainable Wine Growing New Zealand (SWNZ)³⁸ and CarboNZero³⁹ certification. Their Grove Mill and Sanctuary wines are among the world's first carbon-neutral consumer products.⁴⁰ All significant aspects of production and distribution to overseas markets were included in the measurements to produce their emissions profile (see Figure 3). In order to meet the requirements of the CarboNZero programme, energy efficiency improvements were made throughout the winery and packaging was redesigned to optimise the use of maritime freight. Remaining unavoidable emissions were offset by investing in the regeneration of indigenous forest through the EBEX21 forest sinks project.⁴¹

Action taken to reduce emissions has been achieved without impacting on product quality; the company has continued to win prestigious wine awards. Additional benefits include bottom line cost savings and value added to the two brands. Since gaining certification, staff have identified more opportunities for emissions reduction, thus ensuring that further improvements can be made before their next CarboNZero assessment. The business benefits were quickly realised when the supermarket chain Sainsbury's, the sole UK distributor of the Sanctuary brand, decided to stock more of the Sanctuary range and insisted that these carry the CarboNZero label because the initiative sat so well with their own environmental ethos.

Figure 3: Emissions profile for the New Zealand Wine Company.



GHG emissions are continuing to rise and urgent international action is needed to avoid serious environmental and economic damage. Failing to take action to address climate change impacts may lead to international sanctions against export products in the form of taxes and other penalties.⁴² New Zealand exporters have an opportunity to build on the "clean, green" New Zealand brand by:

- acknowledging the GHG emissions associated with production and distribution to market of their products, and putting these in the context of GHG emissions associated with alternative supply chains.
- committing themselves to reduction of GHG emissions.
- moving the debate on to a more thoughtful consideration of globalisation versus localisation, and its implication for all countries.

In this way, New Zealand exporters can make their products more attractive in overseas markets where consumers are concerned about climate change. However, robust scientifically based information is needed to report on the GHG emissions and there also needs to be clear evidence of emissions reduction. Offsetting emissions alone may attract accusations of "greenwash" or buying a good emissions profile.⁴³

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³⁸ See www.nzwine.com/swnz/

³⁹ CarboNZero^{Carb™} is a certified brand owned and administered by Landcare Research – See www.carbonzero.co.nz/

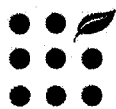
⁴⁰ See www.grovemill.co.nz/

⁴¹ EBEX21®, Emissions Biodiversity Exchange for the 21st century, is a project owned and managed by Landcare Research to assist forest sinks projects based on the regeneration of indigenous forests – See www.ebex21.co.nz.

⁴² Stern S (2006). *The Stern Review: The Economics of Climate Change*. HM Treasury, London. See 22.8 Interactions with the international trade regime.

⁴³ Climatebiz (2006). *Carbon Offsets: The Big Picture*. Greener World Media Inc. See www.climatebiz.com/

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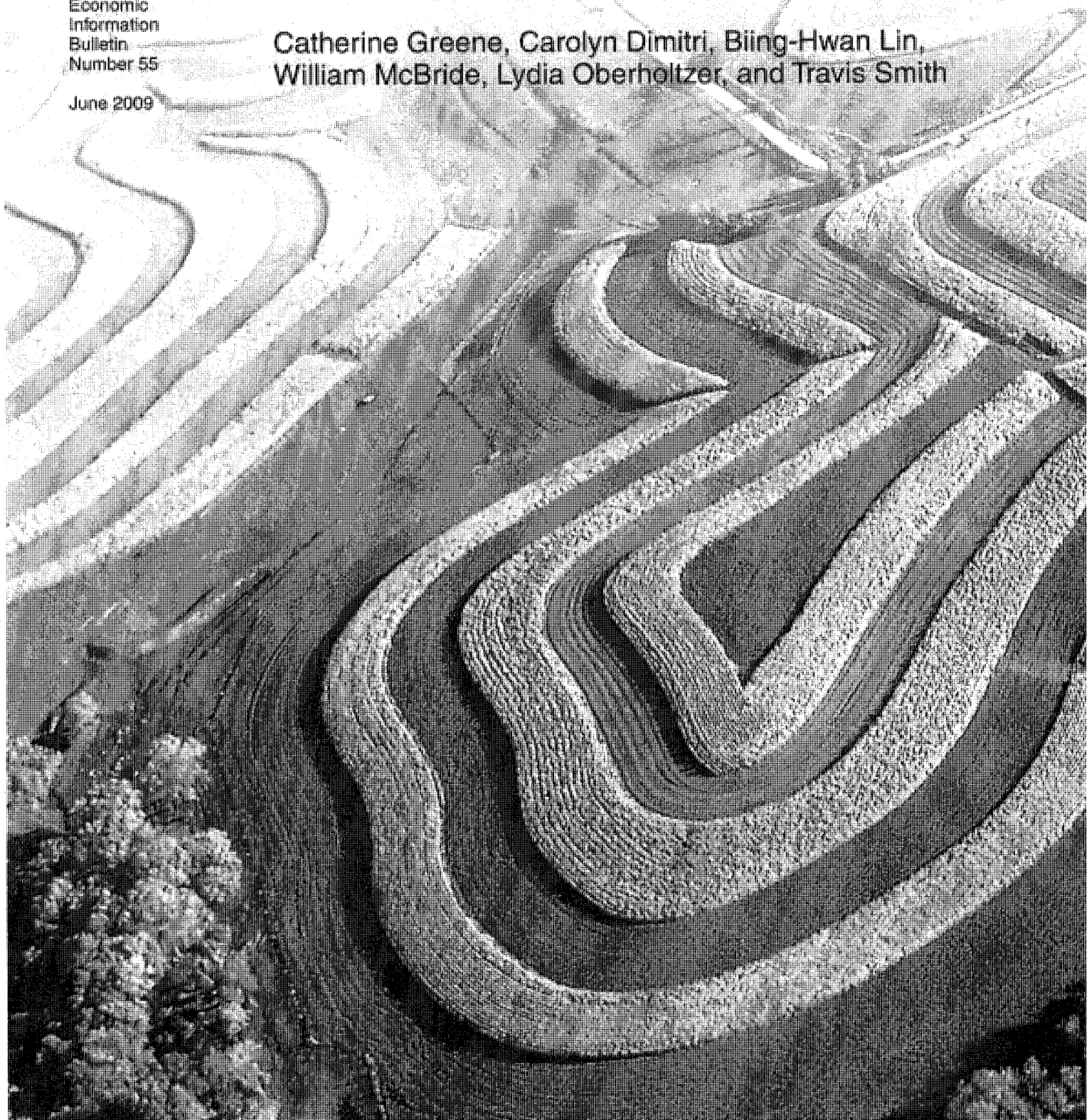
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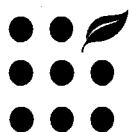
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Emerging Issues in the U.S. Organic Industry

**Catherine Greene, Carolyn Dimitri,
Biing-Hwan Lin, William McBride,
Lydia Oberholtzer, and Travis Smith**

Abstract

Consumer demand for organic products has widened over the last decade. While new producers have emerged to help meet demand, market participants report that a supply squeeze is constraining growth for both individual firms and the organic sector overall. Partly in response to shortages in organic supply, Congress in 2008 included provisions in the Food, Conservation, and Energy Act (2008 Farm Act) that, for the first time, provide financial support to farmers to convert to organic production. This report examines recent economic research on the adoption of organic farming systems, organic production costs and returns, and market conditions to gain a better understanding of the organic supply squeeze and other emerging issues in this rapidly changing industry.

Keywords: organic agriculture, farmers, handlers, consumers, organic production costs, organic supply, marketing organic products, organic label, organic price premiums, local food, organic food imports.

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Summary

Consumer demand for organic food has risen quickly over the past decade, triggered in part by the development and success of USDA's organic regulatory program and label. This rapid growth highlights challenges still to be overcome in the organic sector. As consumer demand for organic products has widened, organic retail sales have spread far beyond the "natural products" market niche in urban areas and college towns and into big-box stores across the country. The 2008 Farm Act includes many new provisions to help domestic producers meet the challenges of organic agriculture and facilitate consumer access to organic food.

What Is the Issue?

Since the late 1990s, U.S. organic production has more than doubled, but the consumer market has grown even faster. Organic food sales have more than quintupled, increasing from \$3.6 billion in 1997 to \$21.1 billion in 2008. More than two-thirds of U.S. consumers buy organic products at least occasionally, and 28 percent buy organic products weekly, according to the Organic Trade Association. This fast-paced growth has led to input and product shortages in organic supply chains, and several new issues—concern about premium-priced product sales in a tight U.S. economy, as well as competition from new environmental labels—are emerging in the organic industry.

What Did the Study Find?

Significant price premiums, fast-paced growth in demand, and fluctuating market conditions have characterized the U.S. organic sector since the beginning of the decade. Early in the decade, demand for organic products outpaced supply, and market participants reported that a supply squeeze was limiting growth in the overall sector. For example, 44 percent of organic handlers reported short supplies of needed ingredients or products in 2004, according to an ERS nationwide survey, and 13 percent were unable to meet market demand for at least one of their organic products that year.

More recently, U.S. organic producers and manufacturers have had to contend with the impact of a weaker U.S. economy on organic food sales. Surveys suggest that many organic consumers may not be particularly sensitive to the price premium paid for organic products. While frequent buyers of organic products may not change their organic purchasing habits even with the current economic slowdown, infrequent buyers may limit their purchases of organic products, and the rate of gain for new organic consumers may decline.

The low organic adoption rate for grain crops continues to be a bottleneck for expansion of the U.S. organic livestock sector, as organic livestock producers struggle to find reliable sources of affordable feed grains. Only 0.2 percent of U.S. corn and soybean crops were grown under certified organic farming systems in 2005, according to ERS estimates.

Organic imports have increased as U.S. demand for organic products has exceeded domestic supply. USDA-accredited groups certified 27,000 producers and handlers worldwide to the U.S. organic standard in 2007, with approximately 16,000 in the United States and 11,000 in over 100 foreign

countries. Organic handlers reported relying primarily on domestic suppliers in 2004, although 38 percent imported some or all of their organic products.

At the retail level, organic produce and milk, the two top organic food sales categories, receive significant price premiums over conventionally grown products. ERS analyzed organic prices for 18 fruits and 19 vegetables using 2005 data on produce purchases, and found that the organic premium as a share of the corresponding conventional price was less than 30 percent for over two-thirds of the items. The premium for only one item—blueberries—exceeded 100 percent. In contrast, organic price premiums for a half-gallon container of milk ranged from 60 percent for private-label organic milk above branded conventional milk in 2006 to 109 percent for branded organic milk above private-label conventional milk.

Organic food costs more to produce and also commands significant price premiums at the farm level. According to recent ERS analysis of national dairy and soybean survey data, total economic costs were significantly higher for organic dairy and soybean operations than for conventional operations. With an average price premium of \$6.69 per hundredweight for organic milk, organic milk producers covered most of the additional costs of organic production in 2005. In 2006, organic soybeans were more profitable than conventional soybeans, mainly because the price premiums paid for organic soybeans compensated for their higher cost of production.

Organic producers also face competition from new labels like the “locally grown” label. USDA organic regulations define organic production as an ecological production system that fosters cycling of resources, promotes ecological balance, and conserves biodiversity, but the regulations do not address where organic farmers and handlers market their products. According to an ERS survey of organic handlers, 24 percent of organic sales in 2004 were made locally (within an hour’s drive of the handlers’ facilities) and another 30 percent were made regionally. Partly in response to organic supply shortages, Congress in 2008 boosted funding for organic research and for a certification cost-share program in the Food, Conservation, and Energy Act. Congress also made conservation practices related to organic production and transition eligible for payments of up to a \$20,000 annual limit, with an \$80,000 cap over a 6-year period, under the Environmental Quality Incentives Program.

How Was the Study Conducted?

The study drew on a range of ERS studies and surveys on organic production and handling, and conducted an extensive literature review to better characterize the U.S. organic sector. One set of studies has analyzed data from certification groups for over a decade to track adoption patterns within the U.S. organic sector. In recent years, ERS has surveyed organic soybean producers and organic dairy producers in USDA’s annual Agricultural Resource Management Survey. ERS has also tracked the characteristics and purchasing patterns of U.S. organic consumers for two major organic food sectors—produce and dairy—using retail food purchase data, which are scanned at home by a nationally representative panel of consumers. Findings are also presented from ERS’s first nationwide survey of practices in the U.S. organic handling sector (organic manufacturers, processors, distributors, and other organic intermediaries), conducted in 2004.

Introduction

Consumer demand for organic food has risen quickly over the past decade, triggered in part by the development and success of USDA's organic regulatory program and label (Kiesel and Villas-Boas, 2007; Molyneaux, 2007; Batte et al., 2007). This rapid growth highlights challenges still to be overcome in the organic sector. As consumer demand for organic products has widened, organic retail sales have spread far beyond the "natural products" market niche in urban areas and college towns and into big-box stores across the country. While new producers have emerged to help meet demand, market participants report that a supply squeeze is constraining firm growth and limiting growth in the overall sector.

In 2008, organic policy at the Federal level moved in new directions. Congress mandated an increase in organic research and certification assistance and created new funding opportunities in conservation, credit, and trade programs. Citing the potential environmental benefits of organic farming, the 2008 Farm Act includes provisions for financial support to farmers converting to organic production through USDA's conservation program, EQIP (Environmental Quality Incentives Program).

Federal activity on organic agriculture began increasing at the beginning of the decade when USDA set national organic standards (see box, "National Organic Standards and Certification"). USDA's Economic Research Service and partner agencies have initiated a number of new organic surveys and studies during the last few years. This report examines recent economic research on organic farming systems, supply chains, price premiums, and market conditions to gain a better understanding of the emerging issues in this rapidly changing industry.

National Organic Standards and Certification

Private organizations, mostly nonprofit, began developing certification standards in the early 1970s as a way to support organic farming and prevent consumer fraud. Some States began offering organic certification services in the late 1980s for similar reasons. The resulting patchwork of standards in the various certification programs, however, caused a variety of market problems.

Congress passed the Organic Foods Production Act of 1990 to establish national standards for organically produced commodities, and USDA promulgated final rules for implementing this legislation in December 2000, with an 18-month transition period. As of October 2002, all agricultural products sold, labeled, or represented as organic need to be in compliance with the regulations. They require that organic growers and handlers (including food processors and distributors) be certified by State or private agencies/organizations under the uniform standards developed by USDA, unless the farmers and handlers sell less than \$5,000 a year in organic agricultural products. Retail food establishments that sell organically produced agricultural products, but do not process them, are also exempt from certification.

The national organic standards address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products. Although specific practices and materials used by organic operations may vary, the standards require every aspect of organic production and handling to comply with the provisions of the Organic Foods Production Act. Organically produced food cannot be produced using genetic engineering, sewage sludge, or ionizing radiation. These standards include a national list of approved synthetic, and prohibited nonsynthetic, substances for use in organic production and handling.

USDA organic standards for food handlers require that all nonagricultural ingredients, whether synthetic or nonsynthetic, be included on the national list. Handlers must prevent the commingling of organic with nonorganic products and protect organic products from contact with prohibited substances. In a processed product labeled as "organic," all agricultural ingredients must be organically produced unless the ingredient(s) is (are) not commercially available in organic form. National Organic Program regulation 7 CFR 205, Section 205.606, specifies which non-organic agricultural products may be considered as commercially unavailable.

The labeling requirements under the national standards apply to raw, fresh, and processed products that contain organic ingredients and are based on the percentage of organic ingredients in a product. Agricultural products labeled "100-percent organic" must contain (excluding water and salt) only organically produced ingredients. Products labeled "organic" must consist of at least 95 percent organically produced ingredients. Products labeled "made with organic ingredients" must contain at least 70 percent organic ingredients. Products with less than 70 percent organic ingredients cannot use the term organic anywhere on the principal display panel but may identify the specific ingredients that are organically produced on the ingredients statement on the information panel. The USDA organic seal—the words "USDA organic" inside a circle—may be used on agricultural products that are "100-percent organic" or "organic." A civil penalty of up to \$11,000 per violation can be levied on any person who knowingly sells or labels a product as organic that is not produced and handled in accordance with the regulations.

For further information, visit USDA's Agricultural Marketing Service/National Organic Program website, at www.ams.usda.gov/nop/.

U.S. Market Growth Outpaces Domestic Supply

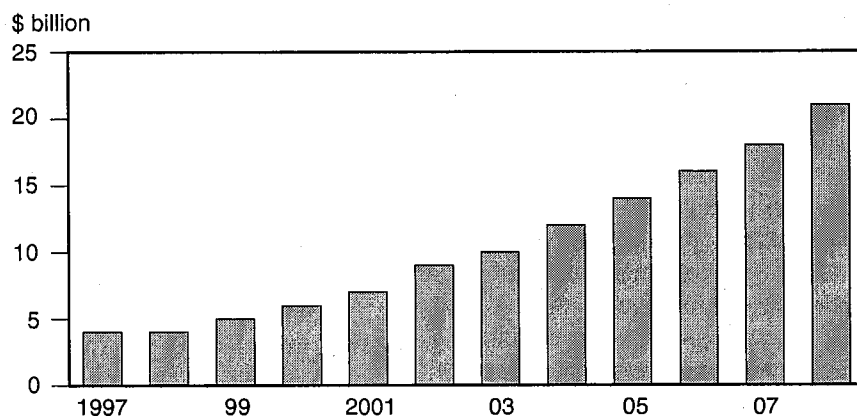
Since the late 1990s, U.S. organic production has more than doubled, but the consumer market has grown even faster. Organic products are now firmly established in the American food culture: once available only in natural product stores, organic foods are now found in mainstream venues like Wal-Mart, Target, and Costco. While organic food sales are rising from a small base and still account for only about 3 percent of total food sales, most Americans now purchase organic products at least occasionally. According to an annual industry survey, 69 percent of U.S. consumers purchased organic products in 2008 (Hartman Group, 2008).

Growing consumer interest in organic food has brought a number of changes to markets and supply chains. Long-time organic retailers, manufacturers, distributors, and farmers face new competition from their conventional food counterparts. For example, large conventional food manufacturers—such as General Mills, Kellogg's, and Dean Foods—initially gained access to organic markets by acquiring independent, successful organic companies. More recently, conventional food manufacturers have competed head-on with independent organic companies by introducing organic versions of their well-known products, such as Gerber baby food. Conventional supermarkets are introducing “private label” store-brand lines of organic food. And organic food supplies are increasingly being imported from farmers in dozens of other countries that are producing products to meet USDA's organic standards.

Organic Sales Have Quintupled Since 1997

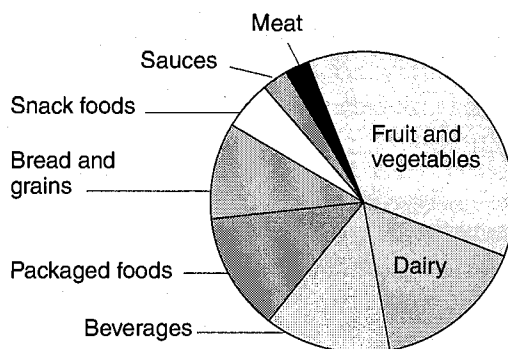
Organic food sales increased from \$3.6 billion in 1997 to \$21.1 billion in 2008 (fig. 1). Sales of organic foods increased annually between 12 and 21 percent during this period (*Nutrition Business Journal*, 2008). Market penetration has also grown steadily; organic food products accounted for over 3 percent of total U.S. food sales in 2008. The top two categories—produce

Figure 1
U.S. organic food sales topped \$21 billion in 2008



Source: *Nutrition Business Journal*.

Figure 2
Fruits, vegetables, and dairy accounted for over half of the \$19 billion organic food market in 2007



Source: *Nutrition Business Journal*.

and dairy products—accounted for over half of organic food sales (fig. 2). These categories are followed by soymilk and other beverages, packaged foods, breads/grains, snack foods, condiments, and meat.

Other organic products (herbal supplements, personal care products, pet food, flowers, linens, and clothing) are growing from a smaller base—\$1.6 billion in sales in 2007—but are forecast to grow even faster than organic food sales through the end of the decade (Organic Trade Association, 2008). The fast-paced growth of organic food and other products has led to complaints of supply shortages throughout the organic supply chain.

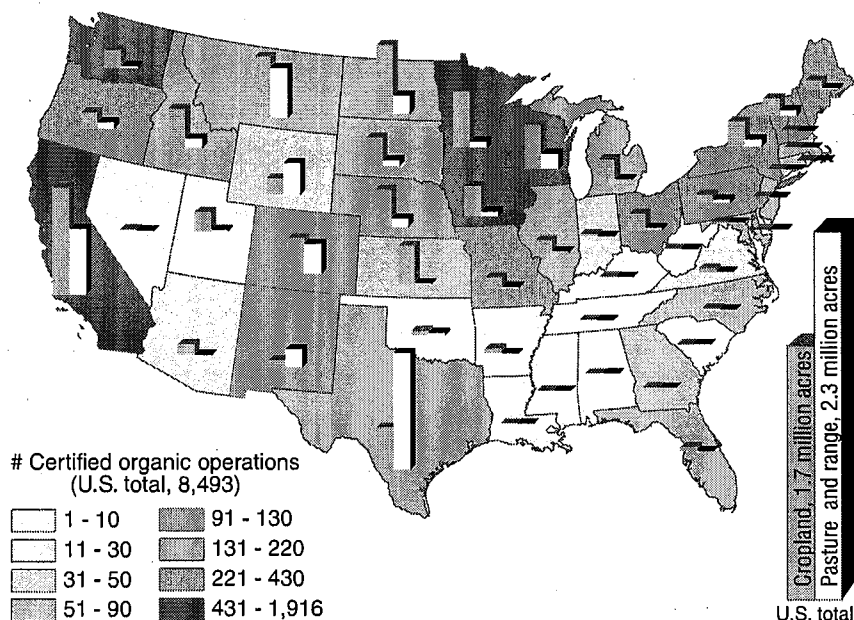
U.S. Organic Acreage Has Doubled Since 1997, But Producers Face Challenges

U.S. certified organic crop acreage more than doubled between 1997 and 2005, and organic production has spread to every State and commodity sector (fig. 3) (USDA-ERS, 2009a). The structure of the U.S. organic production sector differs substantially from the conventional sector: fruits and vegetables account for a much larger percentage of total organic acreage, and organic farms tend to be smaller than conventional farms (Greene and Kremen, 2003; McBride and Greene, 2007). Small-scale organic operations market directly to consumers, as well as to wholesalers, natural food stores, and supermarkets. Many organic production sectors, including fruits, vegetables, dairy, and poultry, are expanding rapidly in the United States. However, the pace of expansion has slowed in some sectors, and organic acreage for some crops—including cotton and soybeans—declined between 2000 and 2005.

The overall adoption level for organic agriculture is still low—only about 0.5 percent of all U.S. cropland and 0.5 percent of all U.S. pasture was certified organic in 2005. Although nearly 5 percent of U.S. vegetable acreage and 2.5 percent of fruit and nut acreage was under organic management in 2005, only 0.2 percent of U.S. corn and soybean crops were grown under certified organic farming systems (fig. 4). Conventional grain producers in the United States associate a wide variety of financial and other risks with organic production (Yeager, 2006; Wolf, 2006).

Figure 3

U.S. certified organic acreage and operations, 2005



Source: USDA Economic Research Service, based on information from USDA-accredited certifiers.

Organic Handlers Cope With Supply Shortfalls

During the early 1990s, organic farmers identified lack of consumer demand as a major marketing problem, and organic farmers frequently sold organic products into conventional markets (OFRF, 1993, OFRF, 1996). While limited demand can still be a problem at times for organic products, limited organic supply has become a bigger issue over the last decade. By the late 1990s, organic handlers—the intermediaries in organic supply chains—faced difficulty procuring large enough quantities of organic products to distribute to retailers, locating organic producers to buy from, and gaining access to shelf space in supermarkets (Dimitri and Richman, 2000).

More recently, long-time organic handlers have reported that the lack of reliable supplies for organic raw materials is a major factor that has constrained business growth (Oliver, 2006; Organic Trade Association, 2006, 2004, 2001). One of the most recurrent themes in a congressional public hearing on organic agriculture, held in April 2007, was the shortage of organic inputs, ingredients, and products (Subcommittee on Horticulture and Organic Agriculture, 2007). According to testimony from the Organic Trade Association (OTA), 52 percent of the organic companies responding to an OTA membership survey reported that “a lack of dependable supply of organic raw materials has restricted their company from generating more sales of organic products” (Wilcox, 2007).

In particular, organic dairy producers and soy food processors face shortages of domestically produced organic feed grains and soybeans (Clarkson, 2007). Quarterly farm-level prices for organic grains and feedstuffs have risen steadily since USDA began tracking prices for these products in January

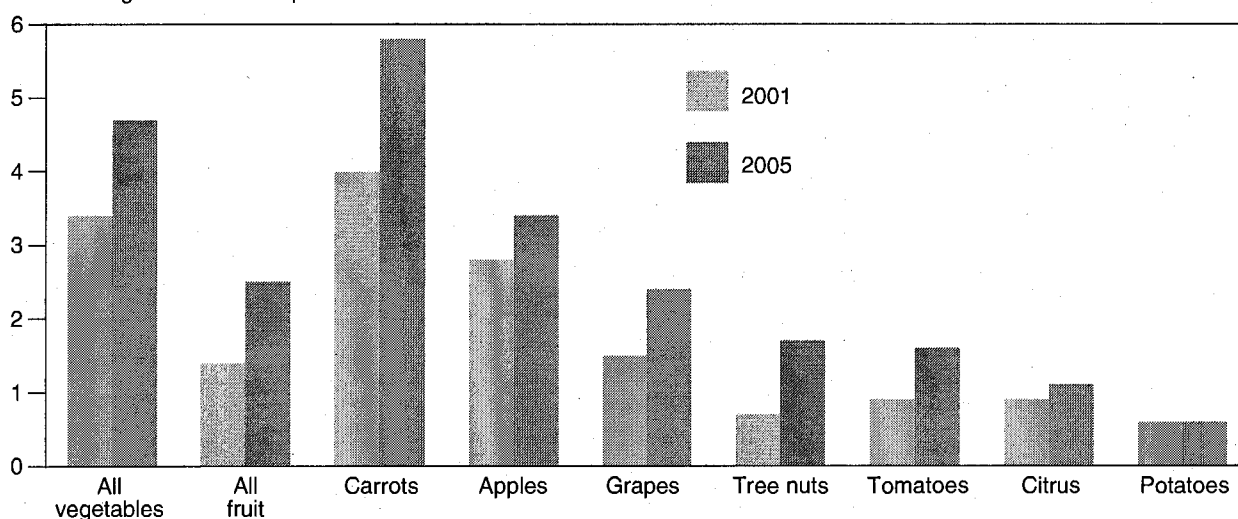
2007—in some cases more than tripling by third-quarter 2008—outpacing conventional grain price increases and reflecting tight organic supplies.

In 2005, ERS surveyed all certified organic handlers in the United States (approximately 2,790 facilities) about their practices in 2004 (Dimitri and Oberholtzer, 2008b). Organic handlers (including brokers, distributors, wholesalers, and manufacturers) must maintain the organic integrity of a product as it moves along the supply chain, but can achieve compliance with the national standards quicker than farmers. Facilities were few in most States, with the Pacific States accounting for 41 percent of the total. In 2004, many organic handlers were small; 48 percent reported \$1 million or less in total gross sales (both organic and conventional products) (fig. 5). Just 3 percent of handlers reported over \$100 million in sales. Most organic handling

Figure 4

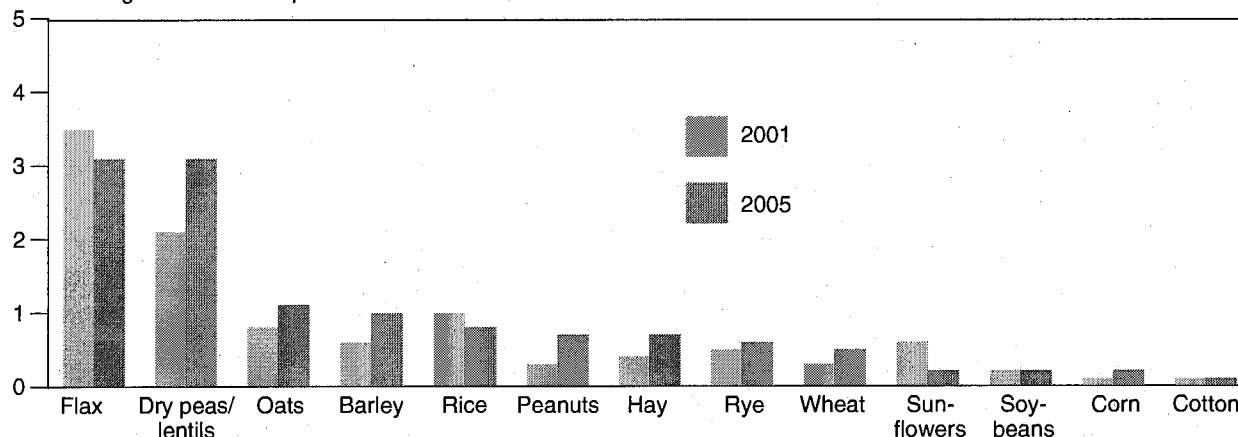
In the U.S., adoption of certified organic systems is highest for fruit and vegetables

Certified organic acres as a percent of total U.S. acres



While certified organic systems are also used for grain crops, adoption is higher for grains with food uses

Certified organic acres as a percent of total U.S. acres



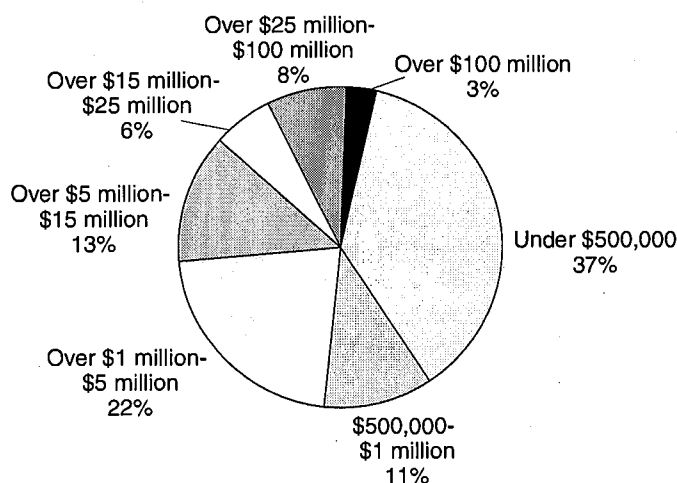
Source: "Data Track the Expansion of International and U.S. Organic Farming," *Amber Waves*, 2007.

firms are mixed operations, handling both organic and conventional products; on average, 34 percent of the sales handled by these firms were organic.

According to the survey findings, 13 percent of all handlers were unable to meet market demand (that is, they experienced critical shortages for at least one of their organic products) during 2004 (Dimitri and Oberholtzer, 2008a). The share of handlers unable to meet market demand varied by the product sold and was highest for milk (fig. 6). These product shortages are mirrored by handlers' difficulties procuring ingredients: 44 percent of handlers found needed ingredients or products in short supply during 2004. The main products and ingredients handlers found in limited supply were coffee, soybeans, milk, seeds (includes seeds for planting), corn, and nuts.

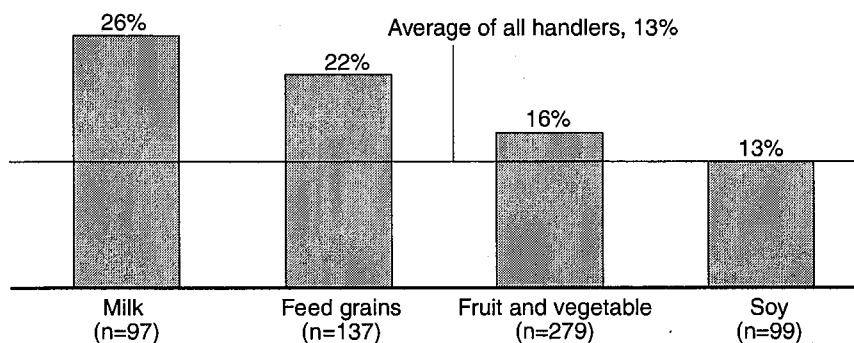
Organic handlers are using a number of mechanisms to cope with shortfalls, such as developing relationships with new or less experienced suppliers, being flexible on shipment size, and providing technical advice (fig. 7).

Figure 5
Share of organic handlers by size of company sales in 2004*



*Includes handlers' gross sales of both organic and conventional products.
Source: 2004 Nationwide Handler Survey, Economic Research Service, USDA.

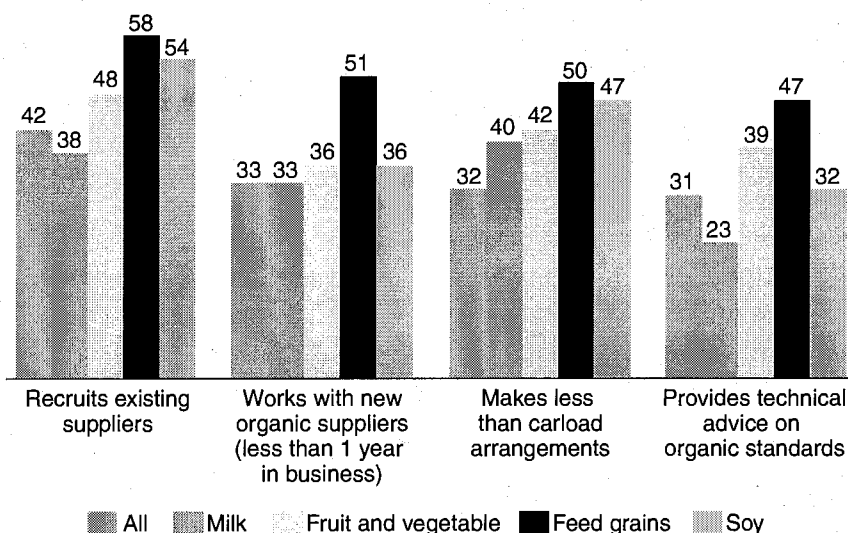
Figure 6
Percent of handlers with critical shortage, by main product sold



Source: 2004 Nationwide Handler Survey, Economic Research Service, USDA.

Figure 7
Handlers work with their suppliers in many ways, 2004

Percent of handlers



Source: 2004 Nationwide Handler Survey, Economic Research Service, USDA.

Handlers willing to work with suppliers new to the organic industry have access to a wider range of supply. Feedgrain handlers are the most willing to work with suppliers new to the sector and, along with soy handlers, are the most flexible about accepting smaller shipments of organic supplies.

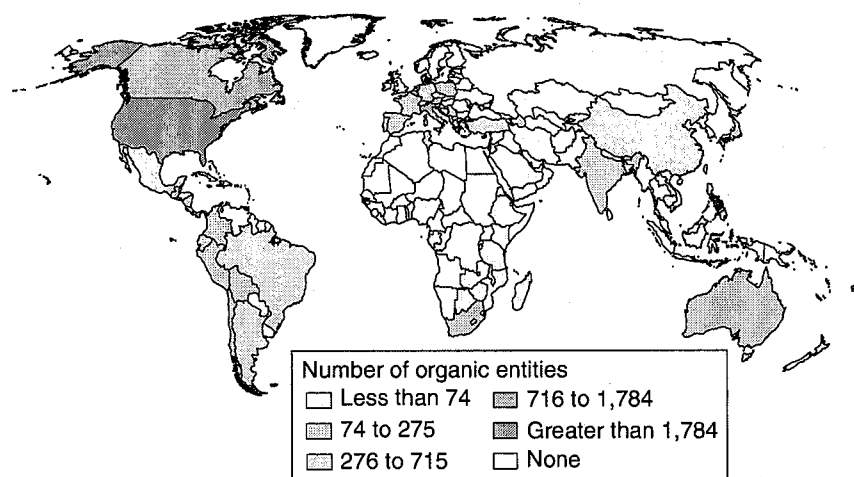
The Search for Organic Supply Goes Global

The U.S. National Organic Program (NOP) streamlined the certification process for international as well as domestic trade when it was implemented in 2002. Organic farmers and handlers anywhere in the world are permitted to export organic products to the United States if they meet NOP standards, along with other regulatory standards, and are certified by a public or private organic certification body with USDA accreditation. In 2007, USDA-accredited groups certified 27,000 producers and handlers worldwide to the U.S. organic standard, with approximately 16,000 in the United States and 11,000 in over 100 foreign countries (fig. 8). Farmers and handlers certified to NOP standards are most numerous in Canada, Italy, Turkey, China, and Mexico, which together accounted for half the total foreign organic farmers/handlers in 2007.

The United States does not have updated, consistent data on organic trade because organic product codes have not yet been added to the U.S. and international harmonized system of trade codes. A USDA report estimated that the value of U.S. organic imports in 2002 was \$1.0-\$1.5 billion and the value of U.S. organic exports was \$125-\$250 million (USDA-FAS, 2005). Organic imports have increased substantially since 2002, and include fresh fruits and vegetables, products not grown in the United States (such as coffee, tea, cocoa, and tropical produce), and raw ingredients, including soybeans.

Imports have increased as growth in organic demand has exceeded domestic supply. Organic farming is often labor intensive, and developing countries

Figure 8
**Number of certified organic entities (farmers and handlers)
 by country, 2007**



Source: USDA National Organic Program.

with lower farm labor costs may have a competitive advantage for some organic products. While USDA's survey of organic distributors, processors, and other handlers indicated that they relied primarily on domestic suppliers, 38 percent imported some or all of their organic products in 2004 (Dimitri and Oberholtzer, 2008a).

Despite the rapid growth of the organic sector and entry of larger organic farms over the last decade, the smallest U.S. organic farms have maintained a stable share of the organic sector (Grow and Greene, 2009). Small-scale farmers producing a wide variety of horticultural products—and increasingly livestock products—for sale in direct markets have likely seen the least impact from competition with more distant suppliers. Organic consumers at farmers' markets, independent restaurants, small food shops, and other direct markets are explicitly seeking locally grown organic products. However, some fruit and vegetable growers who marketed to natural foods grocery stores during the 1990s have reported losing some of their markets to imports and to larger domestic producers as these stores have expanded beyond their original markets (Hanson et al., 2004).

U.S. organic grain and oilseed producers also face international market competition. U.S. organic cotton producers began losing market share in the 1990s to countries with lower labor, input, and technology costs (Greene and Kremen, 2003). U.S. organic soybean production started declining several years ago despite increasing demand for organic feed grains and consumer products such as soymilk. U.S. feed grain distributors and soy product manufacturers report sourcing organic soybeans from other countries.

Organic Food Costs More To Produce

USDA surveyed organic milk producers in 2005, organic soybean producers in 2006, and organic apple producers in 2007 as part of USDA's annual

survey of farm and ranch operators—the Agricultural Resource Management Survey (ARMS)—and will survey organic wheat producers in 2009. These surveys sample organic producers at much higher rates than their occurrence in the population in order to develop sufficient data for a comparison of practices and costs on conventional and organic farms. ERS has completed analysis of organic dairy and soybean production costs and returns.

Organic Dairy Costs and Returns. Organic dairy emerged as a fast growing sector in the late 1990s, and certified organic milk accounted for over 3 percent of U.S. sales of fluid milk products in 2008 (USDA-AMS, 2008). Organic milk producers usually begin as operators of conventional dairies before undergoing what can be a challenging and costly transition process. Conventional dairy producers need to adjust their approach to dairy herd management during the transition to comply with USDA organic standards.

The primary difference in the production practices used by organic versus conventional dairies is in the feeding system (McBride and Greene, 2007). In 2005, more than 60 percent of organic operations reported using pasture-based feeding that provides more than half of seasonal forage (during the grazing months) from pasture, compared to just 18 percent of other operations (table 1). The growth hormone rbST is not available to organic producers, but was used by 17 percent of conventional operations, who also were much more likely to utilize regular veterinary services and a nutritionist. The use of these practices likely contributed to the significantly higher production per cow on conventional versus organic operations. Organic operations averaged about 13,600 pounds of milk per cow in 2005, versus nearly 19,000 pounds on conventional operations.

Measuring Production Costs

ERS computes three levels of production costs for a farm operation. **Operating costs** include costs for feed; veterinary and medical services; bedding and litter; marketing; custom services; fuel, lubrication, and electricity; repairs; hired labor; other costs; and operating interest. **Capital ownership costs** include the annualized cost of maintaining the capital investment (economic depreciation and interest) in the operation, and costs for non-real estate property taxes and insurance. **Total economic costs** are the sum of operating and capital ownership costs, plus opportunity costs for unpaid labor and land, and allocated costs for general farm overhead items.

Total operating costs is an indicator of the relative success of farm operations in terms of their ability to meet short-term financial obligations. The sum of operating and capital ownership costs provides an indicator of whether operations can replace capital assets as needed and thus stay in business over time. Other costs are primarily opportunity costs of owned resources (land and labor) that may or may not influence production decisions.

For organic farm operations, the estimated costs of transitioning to certified organic production are also included in total economic costs. A farm operation must be managed organically for 3 years prior to receiving organic certification and organic price premiums. The higher organic production costs during this period can be considered as the investment necessary to earn higher organic prices over the expected life of the operation.

Costs of production for organic and conventional dairy systems were examined to determine whether organic milk price premiums make organic systems competitive with conventional systems. Average operating and capital costs for organic dairies, including an estimate of the additional costs incurred during transition, were an estimated \$6.38 per cwt of milk higher than for conventional dairies in 2005. With an average price premium of \$6.69 per cwt for organic milk, organic milk producers, on average, covered the additional operating and capital costs of organic production in 2005. This suggests that there may be an economic incentive for small existing dairies (which often have above-average production costs) to transition to organic production.

Table 1

Characteristics and practices of conventional and organic dairy operations, U.S., 2005¹

Item	Type of dairy operation		t-stat
	Conventional	Organic	
Milk cows (per farm)	156	82	1.20
Milk production (lbs per cow)	18,983	13,601	2.63
Region (percent of farms/cows)			
Northeast (ME, NY, PA, VT)	26/17	41/26	1.25/2.55
Upper Midwest (MI, MN, WI)	39/25	43/34	0.13/2.36
Corn Belt (IL, IN, IA, MO, OH)	15/10	8/8	1.18/0.71
Southeast (FL, GA, KY, TN, VA)	6/6	0/0	na
Southwest (AZ, NM, TX)	2/10	0/0	na
West (CA, ID, OR, WA)	11/32	7/32	0.90/0.03
Region (milk cows per farm)			
Northeast (ME, NY, PA, VT)	104	52	0.74
Upper Midwest (MI, MN, WI)	98	64	0.34
Corn Belt (IL, IN, IA, MO, OH)	108	75	0.46
Southeast (FL, GA, KY, TN, VA)	152	0	na
Southwest (AZ, NM, TX)	781	0	na
West (CA, ID, OR, WA)	431	381	0.16
Farm operator			
Off-farm occupation (percent of farms)	2	4	0.24
Education (percent of farms)			
Less than high school	18	26	0.75
Completed high school/some college	66	54	1.38
Graduated from college	16	20	0.59
Age (years)	51	49	0.66
In dairy business (years)	23	21	1.03
Selling certified organic milk (years)	na	5	na
Transition to certified organic (years)	na	2.5	na
Exit dairy business (percent of farms)			
5 years or less	25	16	1.27
10 years or less	51	33	1.99
20 or more years	30	47	2.05
Production practices (percent of farms)			
Pasture based feeding	18	63	6.42
rbST	17	0	na
Regular veterinary services	69	38	3.69
Nutritionist	72	45	3.38
Number of observations	1,462	325	

¹ Statistical significance in test of equality of means is indicated by t-statistics greater than 1.96 and 1.65 at the 5 and 10 percent levels, respectively. na = not applicable.

Source: 2005 Agricultural Resource Management Survey.

Most organic dairies are small operations, with returns that compare favorably with those of small conventional operations. However, at their scale of operation, potential returns to operator labor and management are limited. When the opportunity cost of unpaid labor is included, the average total economic cost of organic milk production was higher than the organic milk price premium in 2005. This suggests that although there may be an economic incentive for small dairies that have already committed much of the fixed investment in milk production to consider becoming organic, the economic incentive for startup organic dairies (which don't have any sunk costs that can be ignored) may be limited. Also, market conditions for organic milk have changed substantially since 2005, with falling milk prices and higher input costs, and many existing organic dairies are currently showing losses (USDA-ERS, 2009b).

Organic Soybean Costs and Returns. Organic soybean acreage in the United States has been stagnant since the early 2000s, despite the fast-growing market for organic soymilk and feed grains, and large price premiums for organic soybeans. Since multidisciplinary research results suggest that growing organic soybeans can be more profitable than growing conventional soybeans, the lack of growth in domestic soybean production relates to a variety of other factors. According to Lynn Clarkson—president of the largest organic grain supply company in the United States—grain supplies are tight despite high demand and price premiums for many reasons: the 3-year lag due to the organic transition period requirement, fewer organic marketing outlets, the need for onfarm storage, the lack of third-party contractors for organic pest and nutrient management, heavy managerial requirements, fear of criticism from neighbors, unknown risks, lack of government infrastructure support, and subsidies for ethanol that increase demand for conventional grain supplies (Clarkson, 2007). Also, as the number of organic soybean producers has increased worldwide, U.S. producers have faced increased competition for the domestic market, as well as for the Japanese organic soybean market, which was a major purchaser of U.S. organic soybeans in the late 1990s and early 2000s.

Research comparing organic and conventional soybean production with long-term experimental trials—using the same seed variety, soil and other conditions—shows that organic cropping systems generate yields and economic returns equal to or greater than those of conventional systems and sometimes much greater returns (Pimentel et al., 2005; Delate et al., 2003; Mahoney et al., 2004; Smith et al., 2004; Hanson et al., 1997). ARMS soybean survey results reflect the commercial setting and the “human factor”—that valuable system of local knowledge and expertise that every farmer acquires through onfarm experience and experiments that plays an especially crucial role in organic farming.

ERS analysis of the 2006 ARMS data from Midwest and Corn Belt States indicates that organic soybean production is conducted on smaller operations than conventional production and that production practices are different (McBride and Greene, 2008). Nearly all conventional producers used genetically modified herbicide-tolerant seed (feed grade) in 2006, while most organic producers used a food-grade seed (table 2). Most conventional farmers used a 3-year rotation of continuous row crops, whereas organic producers more often rotated soybeans with small grains and hay crops. Despite

their smaller size, organic soybean farmers are less likely to report off-farm employment as their major occupation, reflecting higher labor requirements with organic farming.

Average soybean operating costs per acre were not significantly different between conventional and organic producers, but total operating and capital ownership costs and total economic costs were higher for organic soybean production. Conventional producers had higher chemical costs, while organic

Table 2

Characteristics and practices of conventional and organic soybean farms, Corn Belt and Midwest, 2006¹

Item	Type of farm		t-stat
	Conventional	Organic	
Farm characteristic:			
Harvested soybean acres (per farm)	272	117	7.42
Farm acres operated (per farm)	748	478	4.41
Farm operator			
Off-farm occupation (percent of farms)	26	16	3.18
Age (years)	55	54	1.28
More than 65 years (percent of farms)	24	14	2.97
Education (percent of farms)			
Less than high school	5	18	1.73
Completed high school	46	24	3.86
Attended college	50	57	1.07
MI, MN, or WI (percent of farms)	24	51	3.23
Soybean production practice:			
Seed (percent of farms)			
GM herbicide tolerant	97	0	na
Organic clear hilum	0	68	na
Organic other food grade	0	15	na
Organic non-food grade	0	13	na
Other seed	3	5	1.52
Planted in conventional rows	60	92	11.54
Crop rotation (percent of farms)			
Monoculture	4	1	2.58
Continuous row crop	79	19	12.15
Row crops and small grains	4	24	3.13
Idle year	9	40	3.76
Meadow crop	4	17	3.04
Field operation (percent of farms)			
Moldboard plow	5	36	4.53
No-till planter	50	6	14.89
Row cultivator	3	65	9.28
Other practices (percent of farms)			
Irrigation	5	3	1.52
Applied commercial fertilizer	32	7	10.57
Applied manure or compost	7	28	3.08
Soybean yield and price:			
Yield (bushels per planted acre)	47	31	8.63
Price received (dollars per bushel)	5.48	14.64	27.24
Number of observations	1,425	237	

¹ Statistical significance in test of equality of means is indicated by t-statistics greater than 1.96 and 1.65 at the 5 and 10 percent levels, respectively. na = not applicable.

Source: 2006 Agricultural Resource Management Survey

producers substituted field operations for chemicals and had higher fuel, repair, and hired labor costs. They also used more unpaid labor. Average organic soybean yield was lower than that of conventional producers (31 versus 47 bushels per acre), partly because food-grade soybeans produce lower yield than feed-grade soybeans. Average costs for producing organic soybeans were as much as \$6.20 per bushel higher than conventional production in 2006, after accounting for the influence of other factors on production costs, including organic transition costs (McBride and Greene, 2007). The average price premium for organic soybeans was \$9.16 per bushel in 2006, suggesting that organic soybean producers, on average, were sufficiently compensated in 2006 for the additional costs of organic production.

Organic soybeans were more profitable in 2006 than conventional soybeans mainly because of the significant price premiums paid for organic soybeans. However, prices for conventional soybeans increased dramatically in 2007, reducing the organic price premiums from the 2006 level. The yield and cost relationship shown in the ARMS data suggests that when conventional soybean prices are high, organic systems lose their appeal, leading to slower adoption, and even declines in acres planted to organic soybeans.

Organic Agriculture Provides Ecosystem Services

USDA's national regulatory program explicitly defines organic agriculture as an ecological production system, established "to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity" (USDA AMS, 2000). In setting soil fertility and crop nutrient management practice standards, USDA requires organic producers to use practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion. In setting standards for organic livestock, USDA specifies that producers must accommodate an animal's natural nutritional and behavioral requirements, ensuring that dairy cows and other ruminants, for example, have access to pasture. USDA's organic livestock standards also incorporate requirements for living conditions, feed rations, and health care practices suitable to the needs of the particular species.

Environmental benefits that can be attributed to organic production systems include the following:

- **Reduced pesticide residues in water and food.** Organic production systems virtually eliminate synthetic pesticide use, and reducing pesticide use has been an ongoing U.S. public health goal as scientists continue to document its unintentional effects on nontarget species, including humans.
- **Reduced nutrient pollution; improved soil tilth, soil organic matter, and productivity; and lower energy use.** A number of studies have documented these environmental improvements in comparing organic farming systems with conventional systems (USDA Study Team on Organic Farming, 1980; Smolik et al., 1993; Reganold et al., 2001; Mäder et al., 2002; Marriott and Wander, 2006).

- **Carbon sequestration.** Soils in organic farming systems (which use cover crops, crop rotation, fallowing, and animal and green manures) may also sequester as much carbon as soils under other carbon sequestration strategies and could help reduce carbon levels in the atmosphere (Lal et al., 1998; Drinkwater et al., 1998, International Trade Centre-United Nations/World Trade Organization and FiBL, 2007).
- **Enhanced biodiversity.** A number of studies have found that organic farming practices enhance the biodiversity found in organic fields compared with conventional fields (Mäder et al., 2002; Altieri, 1999) and improve biodiversity in field margins (Soil Association, 2000).

Despite the potential for organic agriculture to improve the environmental performance of U.S. agriculture, the national standard is having only a modest impact on environmental externalities caused by conventional production methods because the organic adoption rate is so low.

Higher Food Prices and Local Food Labels

A weaker U.S. economy and higher food prices, along with new competition from food marketed as “locally grown,” have not yet had a major impact on the organic marketplace, but are emerging issues. Retailers passed on higher commodity and energy costs to consumers in the form of higher retail prices in 2008, but lower commodity/energy costs and weaker world economies will likely pull inflation down in 2009 (Leibtag, 2008). Data on retail prices for organic food products are incomplete because the U.S. Bureau of Labor Statistics does not differentiate between organic and non-organic items in the Consumer Price Index. Recent ERS studies show significant retail price premiums for organic produce and milk—the two top organic food sales categories—compared with their conventional counterparts (see box on organic price premiums).

While overall prices for food have increased since 2007, findings from a new national study by the Hartman Group indicate that the percentage of consumers purchasing organic products has remained stable since 2006 (Hills, 2008). Industry analysts suggest that many organic consumers may not be particularly sensitive to price increases for organic products (*Nutrition Business Journal*, 2008).

Organic food purchasing patterns often stand apart from other types of food purchases. Studies by the Economic Research Service and others do not tie high household income to organic purchases, despite relatively high price premiums for organic products. The Hartman Group characterizes organic consumers not as shoppers arriving at a food market in search of the lowest-priced products, but rather as shoppers who want to accomplish tasks on specific shopping occasions by engaging in a compelling set of experiences: “procuring dinner, relaxation, an afternoon workout snack, indulging one’s child, the monthly stock-up trip, and so forth” (Hartman Group, 2007). While frequent consumers of organic products may not change their organic purchasing habits even with the economic slowdown, infrequent buyers may purchase fewer organic products, and the growth rate for consumers new to organic foods may decline. A nationwide survey of food shoppers in 2007 found that consumers who had purchased organic foods but no longer did so cited its expense as the major reason (Food Marketing Institute and *Prevention*, 2008).

“Locally Grown” Label: Complement or Competition?

Agricultural production and food transport both impose environmental costs, and organic production and local distribution can lower these costs (Pretty et al., 2005). Although the requirements for the organic label and for local labels target these different aspects of agriculture—the organic label addresses how food is produced and local labels address where it is produced and distributed—they are often described as competing labels in popular literature.

A recent national survey of U.S. consumers who shop at “natural food” stores posed the following question (*Natural Foods Merchandiser*, 2008): “If you were purchasing a particular ingredient for a recipe and you had a choice of

either a local product or a non-local organic one, which would you choose, assuming equivalent price and quality?" In this head-to-head comparison, 35 percent of respondents chose local and 22 percent chose organic (41 percent chose both equally). Other researchers have reported similar findings on consumer preferences for local over organic food (Leopold Center for Sustainable Agriculture and Iowa State University Business Analysis Laboratory, 2003), and willingness to pay higher premiums for local (Loureiro and Hine, 2001).

The ERS nationwide survey of U.S. organic handlers found that 24 percent of organic sales in 2004 were made locally—within an hour's drive of the handlers' facilities—30 percent were made regionally, and 39 percent were made nationally. A small proportion of domestic organic sales (7 percent) was exported in 2004 (Dimitri and Oberholtzer, 2008b).

Although most retail chains that initiate local programs usually purchase local products from a multistate region, most consumers consider local products as being produced much closer to home—in their State, within 100 miles of their community (*Natural Foods Merchandiser*, 2008). Consumers may also have other misperceptions, such as the belief that local production is environmentally responsible, even though local labels are not typically associated with production standards. According to recent census of agriculture results, approximately 136,000 farmers reported selling agricultural products directly to consumers, while only about 20,000 farmers reported producing organic products (USDA – NASS, 2009).

Organic and local labels are not necessarily competitive. Many long-time participants in the organic market perceive organic and local agriculture as "two sides of the same coin" (Lipson, 2008). Some organic certifying entities, both State and private, already certify producers and processors to a number of other standards—including food safety standards and international organic standards that incorporate a social justice component. A product might easily carry both an organic label, denoting the ecologically based production system used, and a locally grown logo, denoting the number of miles to deliver the product to the consumer.

As the number of farmers' markets in the United States continues to grow, many market managers report strong unmet demand for organic vendors (Kremen et al., 2004). A variety of local-organic food initiatives are emerging in response to the unmet needs for local and organic products in farmers' markets, supermarkets, and institutional settings. Legislation to support local agriculture has been proposed in a number of States in recent years. For example, Illinois passed legislation in 2007 designed to make Illinois the Midwest leader in local and organic food and fiber production, creating a task force to develop strategies to increase local, organic buying programs for public institutions and supporting farmers in transition to organic production (Illinois General Assembly, 2007). A county in Iowa has enacted policies to rebate 100 percent of real property taxes to farmers who convert to organic production and to support local and organic food purchases in county institutional settings. At the Federal level, USDA's Agricultural Marketing Service administers several grant programs that have helped a number of local-organic initiatives in different parts of the country.

Private groups have started local and organic food projects in a few public schools, and a few marketing cooperatives have emerged to market products that are local and organic. One private-sector example is the Appalachian Sustainable Development organic food marketing cooperative in southwest Virginia, which now includes 60 farmers, mostly former tobacco producers, growing and selling certified organic produce to nearly 600 supermarkets in the region (Flaccavento, 2008).

Organic Price Premiums Vary Across Commodities

Surveys provide valuable information about consumer interest in organic products, while analysis of consumer purchases indicates what people buy and how much they pay. Using data on food purchases from a representative sample of U.S. households across the Nation, ERS researchers have completed several studies on consumer purchases of organic produce and milk. These indicate that organic price premiums at the retail level varied by product and location in the mid-2000s, and generally showed higher premiums for milk than for fruits and vegetables.

- ERS analyzed organic prices for 18 fruits and 19 vegetables using 2005 data on produce purchases (Lin et al., 2008), and found that the organic premium as a percent of the corresponding conventional price was under 30 percent for over two-thirds of the items. Organic premiums for vegetables vary somewhat more than for fruits, and the premium for only one item—blueberries (not shown)—exceeded 100 percent.

- The price for organic milk over conventional milk ranged from 72 percent above the conventional price in Western States to 126 percent above the conventional price in the East, based on ERS analysis of milk purchases in 2004 (Dimitri and Venezia, 2007). The national average price pre-

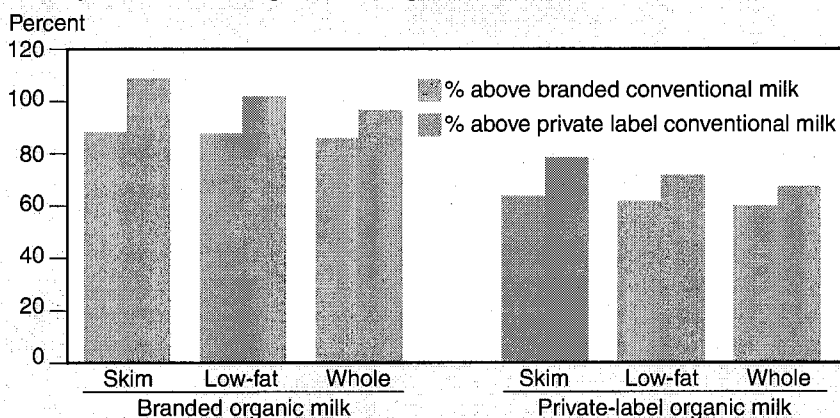
mium for organic milk was 98 percent above the conventional price in 2004.

- Organic milk prices vary by fat content, container size, and branding, based on ERS analysis of milk purchases in 2006 (Smith et al., forthcoming). Organic price premiums for a half-gallon container of milk ranged from 60 percent for private-label organic milk above branded conventional milk, to 109 percent for branded organic milk above private-label conventional milk. Branded organic milk commanded higher premiums than private-label organic milk. In contrast with conventional milk prices,

organic milk prices were estimated to increase as the fat content declined.

ERS also examined the characteristics of organic produce consumers, using a representative sample of U.S. households, and found that Asians and African-Americans tend to purchase organic produce more often than Whites and Hispanics (Stevens-Garmon et al., 2007). Households residing in the West spent more on organic produce, per capita, than those in other regions. This study did not find any consistent positive association between household income and expenditures on organic produce.

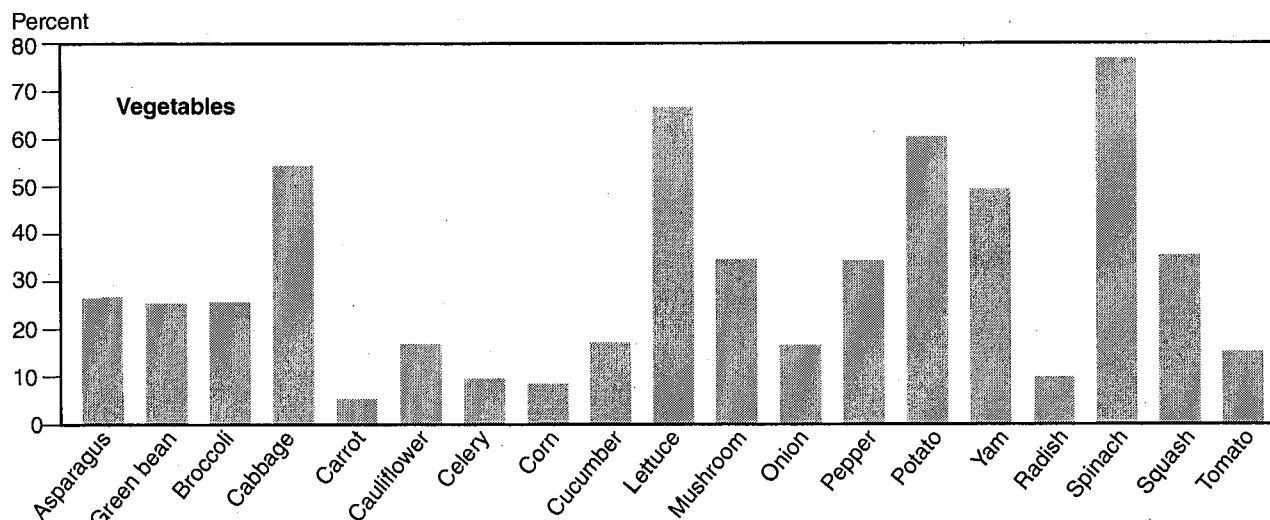
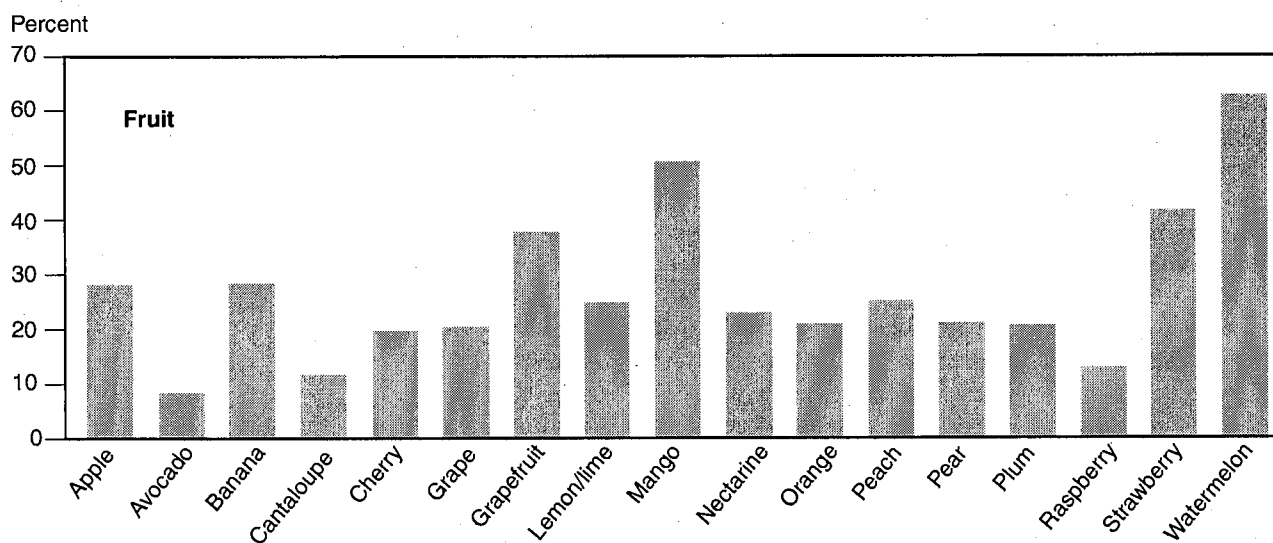
Price premiums: Half gallon of organic milk, 2006



Note: Estimated premiums reflect the percent above average half-gallon conventional milk prices within each fat content category for private-label (store brand) and branded categories.

Source: Nielsen Homescan, 2006.

Organic price premium as percent of conventional price, 2005



Source: Nielsen Homescan 2005.

New Directions in U.S. Organic Policy

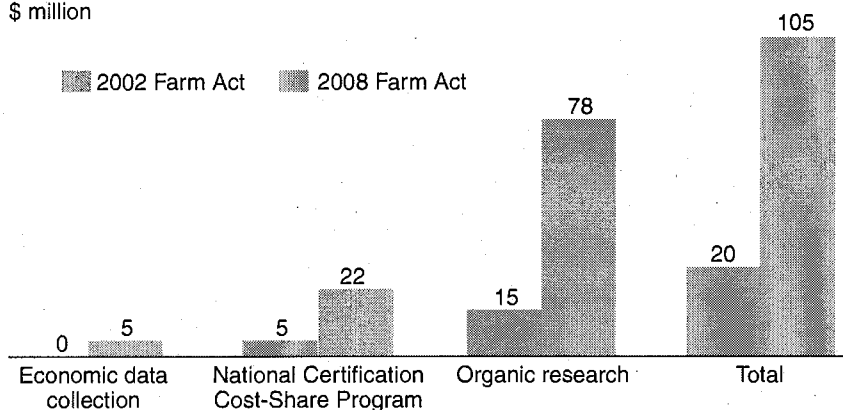
Until recently, Federal organic policy was oriented toward using market support mechanisms to facilitate the growth in the U.S. organic sector. In the Food, Conservation, and Energy Act of 2008 (2008 Farm Act), U.S. Federal organic policy changed course with provisions that provide financial support to farmers to convert to organic production. Under the Organic Transition Support provision in the Environmental Quality Incentives Program, conservation practices related to organic production and the transition to organic production are eligible for payments, subject to a \$20,000 annual limit and an \$80,000 cap over a 6-year period to persons or legal entities.

The 2008 Farm Act also increased mandatory funds for a national certification cost-share program and a data initiative and boosted mandatory organic research funds five-fold from levels mandated in the 2002 Act, specifying two new research priorities (fig. 9). One is to study the conservation and environmental outcomes of organic practices. Although experimental trials have found enhanced soil fertility, higher biodiversity, lower energy use, and increased retention of carbon and nitrogen in organic plots compared with conventional plots, this funding will support more comprehensive research. The potential of organic farming to capture atmospheric carbon and store it in the soil was specifically mentioned in the conference report of the 2008 Farm Act as an example of organic research that needs support.

The other new priority of the organic research initiative is to develop new and improved seed varieties for use in organic production systems. Interest in organic seed variety development was heightened after USDA banned the use of seeds treated with fungicides and the use of genetically modified organism seeds, when national organic standards were implemented in October 2002 (Sooby et al., 2007).

The 2008 Farm Act includes a number of other provisions to facilitate growth in the U.S. organic sector, including technical assistance on organic

Figure 9
Government spending on organic agriculture is up five-fold from 2002
\$ million



Source: Office of Budget and Policy Analysis budget summary data (2002) and Congressional Budget Office (2008).

conservation practices; the inclusion of organic commodities in a cost-share funding program to expand export markets for U.S. agricultural products; a provision to give priority to qualified beginning and socially disadvantaged producers, owners, or tenants who use the loans to convert to sustainable or organic agricultural production systems; funding to expand data collection on organic production and marketing; support for USDA's regulatory program; and a provision to contract for studies of improvement in organic production insurance coverage.

About the Data

Since the late 1990s, USDA's Economic Research Service has initiated a number of studies to better understand and characterize the U.S. organic sector.

U.S. certified organic acreage and livestock—ERS has produced reports based on data from State and private certification groups since the late 1990s to calculate the extent of certified organic farmland acreage and livestock in the United States. Estimates currently show the change in U.S. organic acreage and livestock numbers from 1997 to 2005, by State, for over 40 commodities. Nearly 50 USDA-accredited organic certifiers were operating in the U.S. in 2005, and provided the estimates.

U.S. certified organic handler practices—ERS conducted the first nationwide survey of practices in the U.S. organic handling sector in 2004. Organic manufacturers, processors, distributors, and other organic intermediaries were surveyed about their procurement and contracting of organic products and ingredients. Data are available on 9 commodity groups, such as fruits and nuts, and 45 commodities. The procurement data include information from 1,038 facilities; the contracts data include information from 686 facilities that use contracts.

Characteristics of U.S. organic consumers—ERS has conducted several studies of organic produce consumers using Nielsen Homescan data, which are retail scanner data scanned at home by a nationally representative panel of consumers. These studies used samples of Nielsen Homescan data for the early and mid-2000s containing more than 8,000 households purchasing produce; households reported their purchases of produce sold as random weight or with the Uniform Product Code (UPC) at retail outlets for home consumption. These data were used to determine the socio-demographic characteristics of organic consumers, what they buy, how much they spend, and the price premiums they pay for organic produce. The ERS organic milk study used the full Homescan panel of 41,000 households in 2004, and drew data from the households that bought milk—38,375 households.

Organic production costs and returns—USDA's 2005 Agricultural Resource Management Survey (ARMS) included a subsample of organic dairies and collected detailed information about the production practices and costs on dairy farms in 24 States representing over 90 percent of national milk production. In 2006, information about the production practices and costs of soybean growers in 19 States (representing over 97 percent of U.S. planted soybean acres) was collected. A set of estimates is now available from these surveys that presents costs and returns by region and size of operation for all dairy and soybean producers, and for conventional and organic producers. Estimates for regions and producer size groups with sufficient sample for statistical reliability are also available. ERS also has research on organic agriculture under way using data from the 2007 ARMS survey (which included a subsample of organic apple producers) and will survey organic wheat producers as part of the 2009 ARMS survey.

Conclusions

The organic industry has experienced growing pains since publication of the “USDA organic” label and standards in 2000, which strengthened consumer demand for organic products. Adoption of organic production systems has been uneven across production sectors and regions in the United States, and supply shortages have emerged in some organic food sectors. New public investments in organic research, technical assistance, and support for organic farmers and handlers were included in the 2008 Farm Act. This public investment complements ongoing private efforts to expand organic supply and procure organic products closer to the point of sale. Technical assistance on organic production and financial incentives for organic transition are aimed at providing the tools to help expand the domestic organic grain supply—which in turn supports the fast-growing milk, meat, and poultry sectors—and facilitate organic production in U.S. regions where adoption has been slow. Most American consumers now buy organic products at least occasionally, and could benefit from wider accessibility and enhanced product selection.

Significant price premiums exist for fresh organic produce and organic milk, the two top organic food sales categories, compared with conventional products, reflecting short supply and higher organic production costs. Even if price premiums for organic products can be maintained, the public-goods nature of environmental services, such as biodiversity and water quality, implies that prices do not reflect the true social value of these services. Public investment in organic agriculture facilitates wider access to organic food for consumers and helps farmers capture high-value markets and boost farm income, as well as conserve nonrenewable natural resources and protect U.S. soil and water.

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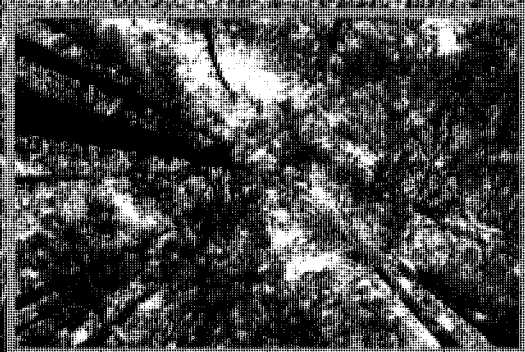
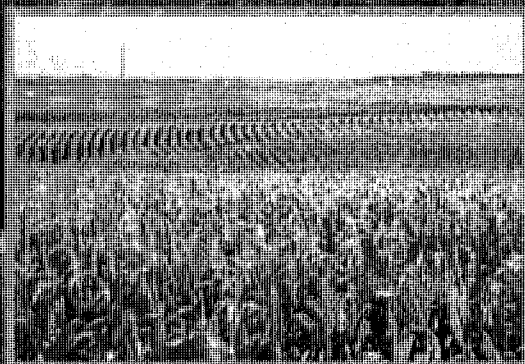
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USDA Agriculture and Forestry Greenhouse Gas Inventory: 1990–2008



Abstract

Emissions of the three most important long-lived greenhouse gases (GHG) have increased measurably over the past two centuries. Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) concentrations in the atmosphere have increased by approximately 38%, 143%, and 18%, respectively, since 1750. In the U.S., agriculture accounted for approximately 6% of total GHG emissions (6,957 Tg CO₂ eq. [teragrams of carbon dioxide equivalent]) in 2008. Livestock, grasslands, crop production, and energy use contributed a total of 462 Tg CO₂ eq. to the atmosphere in 2008. This total includes an offset from agricultural soil carbon sequestration of roughly 40 Tg CO₂ eq. The primary agricultural sources are N₂O emissions from cropped and grazed soils (214 Tg CO₂ eq.), CH₄ emissions from enteric fermentation (141 Tg CO₂ eq.), CO₂ emissions from energy use (72 Tg CO₂ eq.), and CH₄ emissions from managed livestock waste (45 Tg CO₂ eq.). Forests in the United States contributed a net reduction in atmospheric GHG of approximately 886 Tg CO₂ eq. in 2008, which offset total U.S. GHG emissions by approximately 13%. In aggregate, the U.S. agricultural sector (including GHG sources from crop and livestock production, grasslands, energy use and GHG sinks for forests and urban trees) was estimated to be a net sink of 424 Tg CO₂ eq. in 2008.

Keywords: climate change, greenhouse gas, land use, carbon stocks, carbon sequestration, enteric fermentation, livestock waste, nitrous oxide, methane, rice cultivation, energy consumption.

June, 2011

Dear Reader:

I am pleased to present you with this report, *The U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2008*, an update to USDA Technical Bulletin 1921 (2008), which accounted for greenhouse gas emissions and sinks for the agricultural and forestry sectors through 2005.

This report is consistent with the U.S. Environmental Protection Agency's (EPA) *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (April, 2010) in its assessment methods. However, EPA's national-scale reporting here has been disaggregated to provide a State-by-State presentation. We believe this format will serve as a useful resource to land managers, planners, and others with an interest in greenhouse gas dynamics and their relationships to land use and land use change.

Data collection and analysis, as well as coordination of this *Inventory*, could not have been accomplished without the contributions of Stephen Del Grosso, Ronald Follett, and others within USDA's Agricultural Research Service. I also express my thanks to Linda Heath, James Smith, and Rich Birdsey of the USDA Forest Service; James Duffield of USDA's Office of Energy Policy and New Uses; Jerry Hatfield of USDA's Agricultural Research Service; Stephen Ogle at the Natural Resources Ecology Laboratory of Colorado State University; and Tom Wirth in EPA's Office of Atmospheric Programs for their data, analysis, and review. Their thoughtful and diligent efforts compose the foundation of this report, which we hope will serve as a useful resource for a broad spectrum of land management-focused professionals and other interested individuals.

Sincerely,

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Glossary of Terms and Units

CO ₂	Carbon dioxide
CH ₄	Methane
N ₂ O	Nitrous oxide
NO _x	Nitrogen oxides
C	Carbon
GHG	Greenhouse gas
GWP	Global warming potential
Tg	Teragram (10 ¹² grams)
Tg CO ₂ eq.	Teragrams of carbon dioxide equivalent
Gg	Gigagram (10 ⁹ grams)
Mg	Megagram (10 ⁶ grams)
t	Metric ton (1,000 kg)
ha	Hectares
DE	Digestible energy (percent)
Y _m	Fraction of gross energy converted to CH ₄
TDN	Total digestible nutrients
VOCs	Volatile organic compounds
VS	Volatile solids
B ₀	Maximum CH ₄ -producing capacity for domestic wastewater
DM	Dry matter
Btu	British thermal unit
Qbtu	Quadrillion British thermal units
Tbtu	Trillion British thermal units
EF	Emission factor
MCF	Methane conversion factor

Chapter 1: Introduction

1.1 Global Change and Global Greenhouse Gas Emissions in Agriculture and Forestry

In 2008, total U.S. greenhouse gas emissions measured 6,957 teragrams of carbon dioxide equivalents (Tg CO₂ eq.), rising nearly 14 percent from 1990 estimates (EPA 2010). Global concentrations of the three most important long-lived greenhouse gases (GHGs) in the atmosphere have increased measurably since the onset of the Industrial Revolution in 1750. Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) concentrations in the atmosphere have increased by approximately 36%, 148%, and 18% respectively (EPA 2010, Keeling & Whorf 2005, Dlugokencky et al. 2005, Prinn et al. 2000). Agriculture and forestry practices may either contribute to or remove GHGs from the atmosphere. Agriculture and forestry have contributed to GHG levels in the atmosphere through cultivation and fertilization of soils, production of ruminant livestock, management of livestock manure, land use conversions, and fuel consumption. The primary GHG sources for agriculture are N₂O emissions from cropped and grazed soils, CH₄ emissions from ruminant livestock production and rice cultivation, and CH₄ and N₂O emissions from managed livestock waste. The management of cropped, grazed, and forestland has helped offset GHG emissions by promoting the biological uptake of CO₂ through the incorporation of carbon into biomass, wood products, and soils, yielding a total U.S. net emissions of 6,016 Tg CO₂ eq. (net CO₂ flux from Land Use, Land Use Change, and Forestry, EPA 2010). This report serves to estimate U.S. GHG emissions for the agricultural and forestry sectors, to quantify uncertainty in emission estimates, and to estimate the potential of agriculture to mitigate U.S. GHG emissions.

Table 1-1 Agriculture and Forestry Greenhouse Gas Emission Estimates and Uncertainty Intervals, 2008

	Estimate	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Source	Tg CO ₂ eq. ¹			percent	
Livestock	203	185	230	-9	+14
Crops ²	154	84	215	-34	+71
Grassland ²	33	5	132	-84	+298
Energy Use ³	72				
Forestry	(792)	(935)	(651)	-18	+18
Urban Trees	(94)				
Net Emissions	(424)	(587)	(240)	-38	+44

Note: Parentheses indicate net sequestration.

¹ Teragrams of carbon dioxide equivalent.

² Includes sequestration in agricultural soils.

³ Confidence intervals were not available for this component.

Observed increases in atmospheric GHG concentrations are primarily a result of fossil fuel combustion for power generation, transportation, and construction. In the United States, agriculture accounted for 6.1% of total GHG emissions in 2008 (EPA 2010). Greenhouse gas emissions estimates reported here are in units of CO₂ equivalents. Box 1-1 describes this reporting convention, which normalizes all GHG emissions to CO₂ equivalents using Global Warming Potentials (GWP). Agriculture in the United States, including livestock, grasslands, crop production, and energy use, contributed a total of 462 Tg CO₂ eq. to the atmosphere in 2008 (Table 1-1). This total includes an offset, or sink, from agricultural (cropped and grazed lands) soil carbon sequestration of roughly 40 Tg CO₂ eq (Table 1-2). Forests in the United States contributed a net reduction in atmospheric GHGs of approximately 886 Tg CO₂ eq. in 2008, which offset total U.S. GHG emissions by almost 13% (EPA 2010). After accounting for GHG sources and C sequestration, agricultural and forested lands in the U.S. were estimated to be a net sink of 424 Tg CO₂ eq. (Table 1-1). The 95% confidence interval for this estimate ranges from a sink of 587 to 240 Tg

BOX 1-1

The USDA greenhouse gas (GHG) Inventory report follows the international convention for reporting GHG emissions, as described in the introduction of the U.S. GHG Inventory (EPA, 2006). Emissions of GHGs are expressed in equivalent terms, normalized to carbon dioxide using Global Warming Potentials (GWPs) published by the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). Global Warming Potentials, which are based on physical and chemical properties of gases, represent the relative effect of a given GHG on the climate, integrated over a given time period, relative to carbon dioxide (CO₂) (IPCC, 2001). The GWP values used in the U.S. GHG Inventory and this report are recommended by the IPCC for national GHG inventory reporting (Table B1-1). These values for methane (CH₄) and nitrous oxide (N₂O) are referenced to CO₂ and based on a 100-year time period (IPCC, 1996).

Table B1-1 (Reproduced from U.S. GHG Inventory 2003, Table 1-2)
Global Warming Potentials of Selected Greenhouse Gases

Gas	Atmospheric lifetime (yrs)	GWP*
CO ₂	50-200	1
CH ₄	12	21
N ₂ O	120	310

*For consistency with international reporting standards, the U.S. GHG Inventory uses GWP values published in the IPCC Second Assessment Report (1996). Global Warming Potential and estimated atmospheric lifetime values were revised for some gases in the IPCC Third Assessment Report (2001).

In the USDA and U.S. GHG Inventories, units are expressed as teragrams carbon dioxide equivalent (Tg CO₂ Eq.). One teragram equals one million metric tons. The formula for converting gigagrams (1Gg = 10⁹ grams) of a GHG to teragrams (1Tg = 10¹² grams) of carbon dioxide equivalent (Tg CO₂ eq.) is provided in the U.S. GHG Inventory and is repeated here for clarity:

$$\text{TgCO}_2 \text{ eq.} = (\text{Gg of gas}) * (\text{GWP}) * \left(\frac{1\text{Tg}}{1,000\text{Gg}} \right)$$

In the land use sector, where carbon dioxide gas is sequestered and stored as carbon (C) in biomass and soils, greenhouse gas removals are often expressed in units of million metric tons of carbon equivalent (MMTCE). The formula below shows how to convert MMTCE to Tg CO₂ eq., and is based on the molecular weights of carbon and carbon dioxide.

$$\text{TgCO}_2 \text{ eq.} = \text{MMTCE} * \left(\frac{44}{12} \right)$$

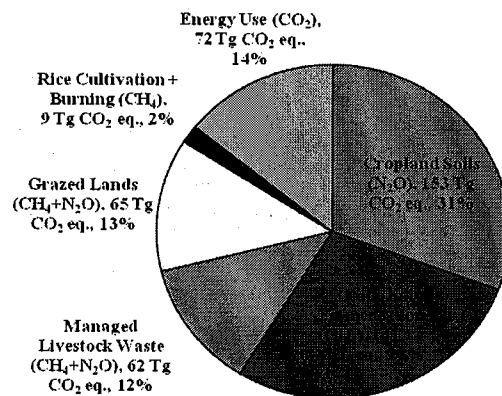
CO₂ eq. (Table 1-1). Approximately one-third of agriculture's GHG emissions in 2008 were due to crop production. Most of the emissions from crop production were from non-rice soils, with residue burning and rice cropping accounting for about 2% of overall agricultural emissions

(Figure 1-1). Livestock production is responsible for most of the remaining agricultural emissions, with about 28% from enteric fermentation, 12% from managed waste, and 13% from grazed lands. The remaining 14% of total emissions result from agriculturally related energy usage, which is listed under the Energy heading by EPA (2010), but is provided here for comprehensiveness. It should be noted that the estimates in Figure 1-1 are for emissions only and do not account for C storage in agricultural soils and forests. Regarding sequestration, forests are by far the leading sink, followed by harvested wood products, urban trees, and agricultural soils (Figure 1-2).

Sources and sinks of emissions are conveniently partitioned (sinks are less than 0) in Figure 1-3. Overall emissions profiles of agricultural sources, including energy use but excluding storage by soils and forestry, show that sources increased 8% between 1990 and 2008 (Table 1-2, Figure 1-3). The sink strength of the forest pool has increased 13% since 1990 (Table 1-2, Figure 1-3). However, the sink strength of agricultural soils has decreased by approximately 57% since 1990. In aggregate, the net emissions decreased slightly from 1990 to 2008 by about 2%.

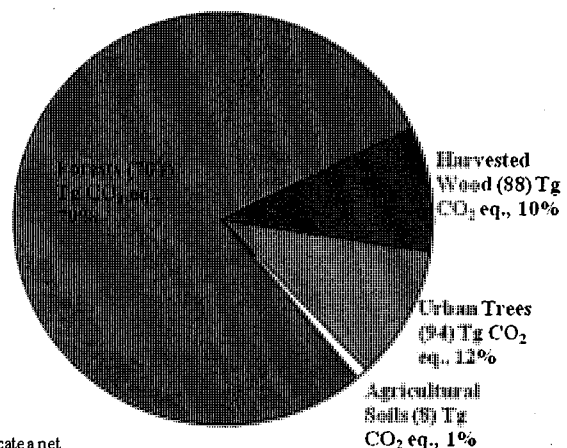
Annual CO₂ emissions from on-farm energy use in agriculture are small relative to total energy use across all sectors in the United States. In 2008, fuel and electricity consumption associated with crop and livestock operations resulted in 72 Tg CO₂ (Table 1-1), which is about 1% of overall energy-related CO₂ emissions for 2008, equaling 5,572.8 Tg CO₂ (EPA 2010). Electricity use led to about 38% of CO₂ emissions from

Figure 1-1
Agricultural Sources of Greenhouse Gas Emission in 2008



Tg CO₂ eq. is teragrams carbon dioxide equivalent.

Figure 1-2
Agricultural Sinks of Carbon Dioxide in 2008

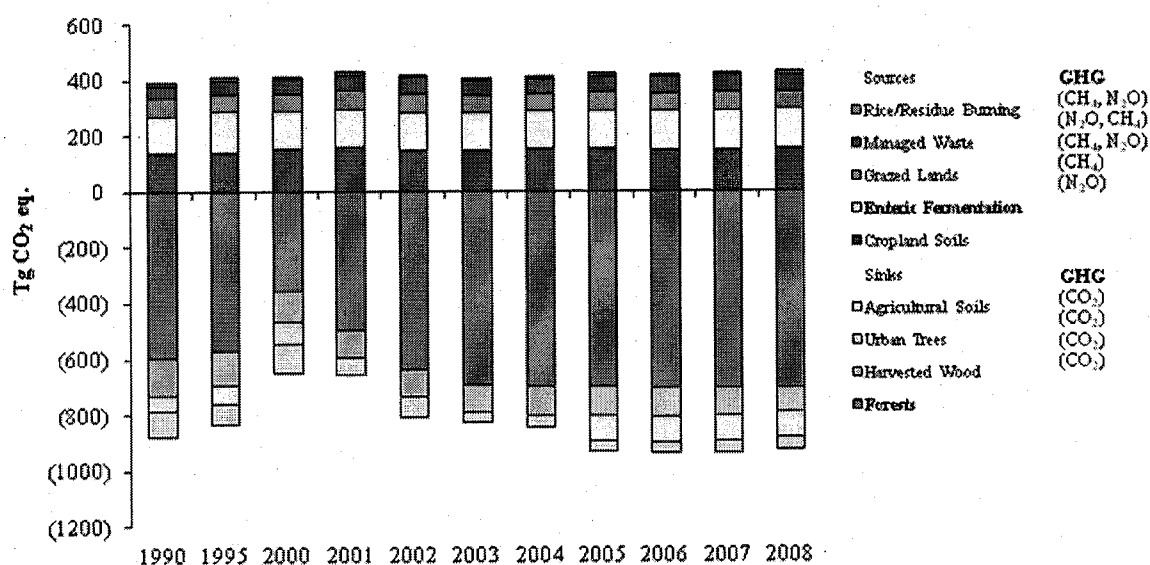


Note: Parenthesis indicate a net sequestration.

Tg CO₂ eq. is teragrams carbon dioxide equivalent.

energy use in agriculture; diesel fuel use led to about 38%, while gasoline, liquefied petroleum gas, and natural gas contributed 11%, 7%, and 5%, respectively, to total CO₂ emissions from energy use in agriculture.

Figure 1-3
Agriculture and Forestry Emissions and Offsets for 1990, 1995, 2000-2008



Note: Parenthesis indicate a net sequestration. Data not reported for CO₂ sequestration by urban trees from 2001-2004.

Tg CO₂ eq. is teragrams carbon dioxide equivalent. CH₄ is methane. N₂O is nitrous oxide. GHG is greenhouse gases.

1.2 Sources and Mechanisms for Greenhouse Gas Emissions

Over half of global annual emissions of CH₄ and roughly a third of global annual emissions of N₂O are believed to derive from human sources, mainly from agriculture (IPCC 2007).

Agricultural activities contribute to these emissions in a number of ways. While losses of N₂O to the atmosphere occur naturally, the application of nitrogen to amend soil fertility increases the natural rate of emissions. The rate is amplified when more nitrogen is applied than can be used by the plants, either due to volume or timing. In agricultural practices, nitrogen is added to soils through the use of synthetic fertilizers, application of manure, cultivation of nitrogen-fixing crops/forages (e.g., legumes), and retention of crop residues. Rice cultivation involves periodic flooding of rice paddies, which promotes anaerobic decomposition of organic matter in soil from rice residue and organic fertilizers by CH₄-emitting soil microbes. Finally, burning of residues in agricultural fields produces CH₄ and N₂O as byproducts.

Livestock grazing, production, and waste cause CH₄ and N₂O emissions to the atmosphere. Ruminant livestock such as cattle, sheep, and goats emit CH₄ as a byproduct of their digestive processes (called "enteric fermentation"). Managed livestock waste can release CH₄ through the

biological breakdown of organic compounds and N₂O through nitrification and denitrification of nitrogen contained in manure; the magnitude of emissions depends in large part on manure management practices and to some degree on the energy content of livestock feed. Grazed lands have enhanced N₂O emissions from nitrogen additions through manure and urine and from biological fixation of nitrogen by legumes, which are typically seeded in heavily grazed pastures. Some pastures are also amended with nitrogen fertilizers, managed manure, and sewage sludge, which also contribute to GHG emissions on those lands.

Table 1-2 Summary of Agriculture and Forestry Emissions and Offsets, 1990, 1995, 2000-2008

		1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Source	GHG	Tg CO ₂ eq.										
Livestock		176.1	193.0	192.0	192.6	194.3	189.3	191.1	195.6	198.6	204.3	203.0
Enteric	CH ₄											
Fermentation		132.4	143.7	136.8	136.0	136.3	134.5	134.6	136.7	139.0	141.2	140.8
Managed Waste	CH ₄	29.3	33.9	38.6	40.1	41.2	38.4	40.2	42.2	42.3	45.9	45.0
Managed Waste	N ₂ O	14.4	15.5	16.7	16.5	16.8	16.3	16.4	16.6	17.3	17.3	17.1
Grassland		(2.1)	5.7	(22.5)	8.9	(4.5)	30.6	31.6	33.4	32.1	31.1	33.2
Grassland	CH ₄	2.9	3.0	2.7	2.8	2.7	2.7	2.8	2.9	3.0	3.0	2.9
Grassland	N ₂ O	64.0	61.6	58.2	63.9	64.2	59.1	60.1	61.8	60.5	59.5	61.7
Grassland	CO ₂	(69.0)	(58.9)	(83.4)	(57.7)	(71.4)	(31.2)	(31.2)	(31.3)	(31.3)	(31.4)	(31.4)
Crops		124.8	136.9	136.7	164.5	156.1	148.4	152.7	153.6	148.5	149.2	153.8
Cropland Soils ¹	N ₂ O	139.1	143.7	151.3	159.7	149.7	147.3	151.9	153.2	150.0	150.7	153.4
Cropland Soils ²	CO ₂	(22.6)	(15.6)	(23.5)	(4.3)	(1.7)	(7.2)	(8.3)	(8.0)	(8.9)	(9.2)	(8.3)
Rice Cultivation	CH ₄	7.1	7.6	7.5	7.6	6.8	6.9	7.6	6.8	5.9	6.2	7.2
Residue Burning	CH ₄	0.8	0.7	0.9	0.9	0.8	0.9	1.0	0.9	0.9	1.0	1.0
Residue Burning	N ₂ O	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Energy Use³	CO ₂	73.9	73.9	73.9	73.9	72.9	71.9	70.9	69.9	70.5	71.0	71.6
Forestry		(786.9)	(759.9)	(545.2)	(593.9)	(737.4)	(790.7)	(805.5)	(894.4)	(902.3)	(898.8)	(885.8)
Forests	CO ₂	(598.1)	(574.2)	(354.8)	(500.5)	(639.2)	(695.9)	(700.2)	(701.2)	(703.9)	(703.9)	(703.9)
Harvested Wood	CO ₂	(131.8)	(118.4)	(112.9)	(93.4)	(98.2)	(94.8)	(105.3)	(105.4)	(108.6)	(103.0)	(88.0)
Urban Trees ⁴	CO ₂	(57.1)	(67.3)	(77.5)	n/a	n/a	n/a	n/a	(87.8)	(89.8)	(91.9)	(93.9)
All												
Net Emissions	GHGs	(414.2)	(350.3)	(165.1)	(154.0)	(318.7)	(350.5)	(359.1)	(441.9)	(452.6)	(443.2)	(424.2)

Note: Parentheses indicate a net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide; CO₂ is carbon dioxide.

¹Includes emissions from managed manure during storage and transport before soil application.

²Agricultural soil C sequestration includes sequestration on land set aside under the Conservation Reserve Program (CRP), in addition to cultivated mineral and organic soils.

³Data interpolated for all years except 2001, 2005 and 2008.

⁴Data not reported for years 2001-2004.

1.3 Strategies for Greenhouse Gas Mitigation

Agriculture and forest management can offset GHG emissions by increasing capacity for carbon uptake and storage in biomass, wood products, and soils. This process is referred to as carbon sequestration. The net flux of CO₂ between the land and the atmosphere is a balance between carbon losses from land use conversion and land management practices, and carbon gains from forest growth and sequestration in soils (IPCC 2001). Improved forest regeneration and management practices such as density control, nutrient management, and genetic tree

improvement promote tree growth and enhance carbon accumulation in biomass. In addition, wood products harvested from forests can serve as long-term carbon storage pools. The adoption of agroforestry practices like windbreaks and riparian forest buffers, which incorporate trees and shrubs into ongoing farm operations, represents a potentially large GHG sink nationally. While deforestation is a large global source of CO₂, within the United States, net forestland area has experienced a relatively small net loss of roughly 4.2 million hectares (Kimble et al. 2003). Avoidance of large scale deforestation and adoption of the practices mentioned above have resulted in the forestry sector being a net GHG sink in the United States.

Agricultural practices such as conservation tillage and grassland practices such as rotational grazing can also reduce carbon losses and promote carbon sequestration in agricultural soils. These practices offset CO₂ emissions caused by land use activities such as conventional tillage and cultivation of organic soils. However, strategies intended to sequester carbon in soils can also impact the fluxes of two important non-CO₂ GHGs, N₂O and CH₄. Consequently, the net impact of different management strategies on all three biogenic GHGs must be considered when comparing alternatives (Robertson et al. 2000, Del Grosso et al. 2005). Innovative practices to reduce GHG emissions from livestock include modifying energy content of livestock feed, supplementing feed with agents that reduce CH₄ emissions from digestive processes, and managing manure in controlled systems that reduce or eliminate GHG emissions. For example, anaerobic digesters are a promising technology, whereby CH₄ emissions from livestock waste are captured and used as an alternative energy source. Nitrous oxide emissions from soils can be reduced by precision application of nitrogen fertilizers and use of nitrification inhibitors. These and other practices, many of which have additional benefits beyond GHG emission reductions, are discussed further in this report.

1.4 Purpose of this Report

The U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2008 was developed to include emission estimates for years not included in the U.S. Agriculture and Forestry Greenhouse Gas Inventories: 1990-2001 (USDA 2004) and 1990-2005 (USDA 2008) and to revise estimates for previous years based on improved methodologies. This inventory provides a comprehensive assessment of the contribution of U.S. agriculture (i.e., livestock and crop production) and forestry to the national greenhouse gas emissions inventory. The document was prepared to support and expand on information provided in the official Inventory of U.S. GHG Emissions and Sinks (U.S. GHG Inventory), which is prepared annually by the U.S. Environmental Protection Agency to meet U.S. commitments under the United Nations Framework Convention on Climate Change (UNFCCC) (EPA 2010). This report, the U.S. Agriculture and Forestry GHG Inventory (USDA GHG Inventory) supplements the U.S. GHG Inventory, providing an in depth look at agriculture and forestry emissions and sinks of GHG and presenting additional information on GHG emissions from fuel consumption on U.S. farms and ranches. The methodologies and emissions reported here are consistent with the EPA (2010) inventory. There are, however, important differences in reporting that should be noted and understood by the reader. For clarity, two examples of these differences will be noted. First, for the EPA inventory, source and sink categories are defined by the UNFCCC. Because of this, CO₂ emissions from agricultural soils are included in the Land Use, Land Use Change, and Forestry (LULUCF) chapter instead of the Agriculture chapter. In this report, CO₂ emissions from grazed

and cropped soils are included in the Livestock and Grazed Land Emissions and Cropland Agriculture chapters, respectively. Second, how energy is distributed among economic sectors is context dependent. This report includes emissions from on-farm energy use, but not the energy emissions associated with the production and transport of farm inputs. The UNFCCC submission (EPA, 2010) combines on-farm energy use with energy associated with farm inputs and reports it in the chapter with energy use from other sectors. Finally, readers should be aware of total versus net emissions. For example, in 2008 total emissions for the United States were 6,957 Tg CO₂ eq., but net emissions were 6,016 Tg CO₂ eq. after accounting for carbon storage in forests, harvested wood products, and agricultural soils.

The U.S. GHG Inventory provides national-level estimates of emissions of the primary long-lived GHGs (carbon dioxide, methane, nitrous oxide, and fluorinated gases) across a broad range of sectors (energy, industrial processes, solvent use, agriculture, land use change and forestry, and waste). Due to the national-level scale of reporting in the U.S. GHG Inventory, that report does not always provide regional or state GHG emissions data. However, in some cases county, state, and regional emissions data are part of the inventory development process and can be used for more disaggregated analyses.

This report customizes the data from the U.S. GHG Inventory in a manner that is useful to agriculture and forestry producers and related industries, natural resource and agricultural professionals, as well as technical assistance providers, researchers, and policymakers. The information provided in this inventory will be useful in improving our understanding of the magnitude of GHG emissions by county, state, region, and land use, and by crop, pasture, range, livestock and forest management systems. The potential to mitigate emissions from cropped soils is also quantified in this edition of the inventory. The analyses presented in this report are the result of a collaborative process and direct contributions from EPA, USDA (Forest Service, Natural Resources Conservation Service, Agricultural Research Service, Office of Energy Policy and New Uses, and the Climate Change Program Office), and the Natural Resources Ecology Laboratory (NREL) of Colorado State University.

USDA administers a portfolio of conservation programs that have multiple environmental benefits, including reductions in GHG emissions and increases in carbon sequestration. This and future USDA GHG Inventory reports will facilitate tracking of progress in promoting carbon sequestration and reducing GHG emissions through agriculture and forest management. The USDA GHG Inventory describes the role of agriculture and forestry in GHG emissions and sinks, including quantitative estimates of GHG emissions reductions and carbon sequestration through agriculture and forest management. Extensive and indepth emissions estimates are presented for all agricultural and forestry GHG sources and sinks for which internationally recognized methods are available. Where possible, emissions estimates are provided at county, state and regional scales in addition to the national levels provided in the U.S. GHG Inventory. Emissions are categorized by additional information such as land ownership and management practices where possible. This report will help to:

- Quantify current levels of emissions and sinks at county, state, regional, and national scales in agriculture and forestry,
- Identify activities that are driving GHG emissions and sinks and trends in these activities,

-
- Quantify the uncertainty associated with GHG emission and sink estimates, and
 - Quantify the mitigation potential of land management practices intended to reduce GHG emissions.

1.5 Overview of the Report Structure

The report provides detailed trends in agriculture and forestry GHG emissions and sinks, with information by source and sink at county, state and regional levels. The report is structured mainly from a land use perspective, addressing livestock operations, croplands, and forests separately, but it also includes a chapter on energy use. The livestock chapter inventories GHG emissions from livestock and livestock waste stored and managed in confined livestock operations as well as pasture and range operations. The cropland agriculture chapter addresses emissions from cropland soil amendments, rice production, and residue burning, as well as carbon sequestration in agricultural soils. The forest chapter details carbon sequestration in forest biomass and soils, urban trees, and wood products. Fluxes of methane and nitrous oxide in forestry are not addressed since little information is currently available to develop estimates for these sources for forests. Qualitatively, forest soils are net methane sinks in the United States and soil N₂O emissions are small because forests do not receive large N additions (<1% of N fertilizer nationally is applied to forest soils, EPA, 2010). The energy chapter provides information on carbon dioxide emissions from energy consumption on U.S. farms, covering GHG emissions from fuel use in livestock and cropland agriculture. While the U.S. GHG Inventory provides estimates of GHG emissions from energy consumption in the production of fertilizer, this indirect source of agricultural GHG emissions is not covered in this report.

Chapters 2 through 5 present a summary of sources of GHG emissions and sinks in the land use or category of emissions covered by each chapter. A summary of GHG emissions at the national level is provided initially, followed by more detailed descriptions of emissions by each source at national and sub-national scales where available. Methodologies used to estimate GHG emissions and quantify uncertainty are summarized. Changes from the second edition of this inventory are indicated. Text describing the methods and uncertainty for some chapters is summarized from the U.S. GHG Inventory, with permission from the EPA.

1.6 Summary of Changes and Additions for the Third Edition of the Inventory

Compared to previous years, more sophisticated methodologies were used in this report to estimate GHG fluxes from all the major categories. When adjustments are made to existing methodologies (e.g., using new data sources), recalculations are made for the entire time series of estimates to ensure consistency. In addition to updating GHG flux estimates for 1990-2005 (based on current methodologies), estimates for 2006-2008 are also included.

Major changes impacting livestock emissions involved revising animal population estimates or diet assumptions, refining the models used to calculate emissions, using updated activity data, applying animal specific emissions factors, and accounting for sources previously neglected (see Chapter 2 for details). Methane conversion rate, digestible energy values for cattle, and feedlot

diets were updated. As a result of these changes, emissions from enteric fermentation increased by approximately 18% on average compared to the previous inventory (USDA 2008). The biggest change for emissions from managed livestock waste is that the inventory now includes indirect N₂O emissions associated with N losses from volatilization of N as ammonia (NH₃), nitrogen oxides (NO_x), and leaching and runoff, as recommended by IPCC (2006). These indirect N₂O emissions are added to the direct N₂O emissions to present a more complete picture of N₂O emissions from manure management. As a result of this change in methodology, N₂O emission estimates from manure management systems have increased by approximately 60 percent compared to the previous inventory. In this edition, N additions to soils from grazing animals are consistent with N excretion data. Nitrate leaching was assumed to be an insignificant source of indirect N₂O in grassland systems where the amount of precipitation plus irrigation did not exceed the potential evapotranspiration, as recommended by IPCC (2006). These changes resulted in an approximately 40 percent decrease in grazed soil N₂O emissions. The biggest change that impacted estimates of carbon dioxide fluxes for grazed lands involved using annual survey data from the USDA National Resources Inventory (NRI). Availability of new data extended the time series of activity data beyond 1997 to 2003. In previous inventories, activity data were only available through 1997 at 5-year intervals, and subsequent years were treated as the same land use practice occurring in 1997. NRI area data were reconciled with the forest area estimates in the Forest Inventory and Analysis (FIA) dataset, and were incorporated into the estimation of soil C stock changes. These changes resulted in an average annual increase in C stocks of soils used for livestock grazing of approximately 40 Tg CO₂ eq. for the time series, compared to the previous Inventory.

Although there were no major changes in methodologies for cropland emissions (Chapter 3) compared to the previous edition (USDA 2008), a series of improvements were implemented. Instead of assuming that nitrate leaching can occur anywhere, a criterion was used to designate lands where nitrate is susceptible to be leached into waterways, as suggested by IPCC (2006). Other changes include: using state-level N data for on-farm use of fertilizers to estimate synthetic N fertilizer application on non-major crops, including uncertainty in model outputs of N volatilization and N leaching/runoff in the calculation of uncertainty for indirect emissions, using a default uncertainty of ±50 percent for Tier 1 uncertainties that were not addressed in the previous inventory (e.g., crop yields and organic fertilizer amendments), improved estimates of manure N available for land application, revising the model parameterization for sorghum, and correcting uncertainty calculations. The main results of these changes are lower N₂O emissions and wider confidence intervals.

Estimates of forest carbon stock changes (Chapter 4) reflect a substantial number of incremental changes in methods and data compared to the previous inventory. The accumulation of newer inventory data for most states, including stocks for coastal (southern and eastern) Alaska and western Texas, affect carbon stock totals and changes compared to previous inventories. Updated land area analysis resulted in reduction of grassland area in the United States, because woodlands previously designated as grassland are now considered forest land, thus increasing the estimation of soil C stock changes in these areas. However, redefining forestland also led to the removal of low cover, lower productivity woodlands areas from the surveys (Smith et al. 2009), which were included in the previous USDA (2008) inventory. On average, these changes increased carbon stock estimates by approximately 8 percent.

Chapter 2: Livestock and Grazed Land Emissions

2.1 Summary of U.S. Greenhouse Gas Emissions from Livestock

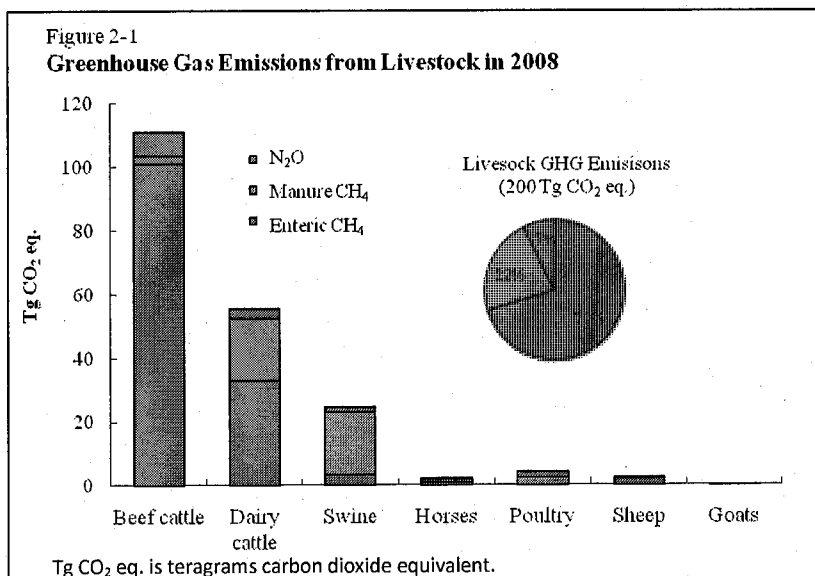
A total of 234 Tg CO₂ eq. of greenhouse gases (GHGs) were emitted from livestock, managed livestock waste, and grazed land in 2008 (Table 2-1, Figure 2-1). This represents about 55% of total emissions from the agricultural sector (EPA 2010). Compared to the baseline year (1990), emissions from this source were about 26% higher in 2008. The 95% confidence interval for 2008 was estimated to lie between 204 and 332 Tg CO₂ eq. (Table 2-1).

Table 2-1 Greenhouse Gas Emission Estimates and Uncertainty Intervals in 2008

Source	Estimate	Lower Bound	Upper Bound	Lower Bound	Upper Bound
		Tg CO ₂ eq.		percent	
CH ₄ enteric fermentation	141	125	166	-11	+18
CH ₄ managed waste + grazed land	48	39	57	-18	+20
N ₂ O managed waste	14	12	18	-16	+24
N ₂ O grazed land	62	39	156	-37	+153
CO ₂ grazed land remaining grazed land	(5)	(7)	(3)	-53	+42
CO ₂ land converted to grazed land	(27)	(29)	(24)	-8	+9
Total	234	204	332	-13	+42

Note: Parentheses indicate a net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent. CH₄ is methane. N₂O is nitrous oxide. CO₂ is carbon dioxide.

Enteric fermentation was responsible for over half (141 Tg CO₂ eq.) of all emissions associated with livestock production, while grazed lands (62 Tg CO₂ eq.) and managed waste (48 Tg CO₂ eq.) accounted for approximately 26% and 20% of the total emissions. All of the emissions from enteric fermentation and about 77% of emissions from managed livestock waste were in the form of methane (CH₄). Of the emissions from grazed lands, 96% were in the form of nitrous oxide



(N₂O) from soils (Table 2-2). Soils in grazed lands do not often experience the anaerobic conditions required for CH₄ production to exceed CH₄ uptake. However, a small portion of manure from grazing animals is converted to CH₄. Grazed lands served as a sink for CO₂ emissions, sequestering 31.4 Tg in 2008 (Table 2-2). The largest total emissions associated with livestock production were from

Texas and California (Map 2-1). Emissions were high in Texas primarily because of the large numbers of beef cattle, while dairy cattle emissions are responsible for most emissions in California. Emissions were also high in Iowa, Nebraska, Kansas, Oklahoma, and Missouri. Beef cattle were responsible for the largest fraction (55%) of GHG emissions from livestock in 2008, with the majority of emissions in the form of CH₄ from enteric fermentation and N₂O from grazed land soils (Figure 2-1, Table 2-2). Dairy cattle were the second largest livestock source of GHG emissions (28%), primarily CH₄ from enteric fermentation and managed waste. The third largest GHG source from livestock was swine (12%), nearly all of which was CH₄ from waste. Horses, goats, and sheep caused relatively small GHG emissions when compared to other animal groups, because populations of these types are relatively small.

Table 2-2 Greenhouse Gas Emissions by Livestock Category and Source in 2008

	Enteric Fermentation	Managed Livestock Waste		Grazed Land		<i>Total</i>
	CH ₄	CH ₄	N ₂ O	N ₂ O ¹	CH ₄ CO ₂	
Animal Type			<i>Tg CO₂ eq.</i>			
Beef cattle	100.77	2.47	7.44	51.90	1.97 (26.40)	138.2
Dairy cattle	33.09	19.43	5.48	1.68	0.05 (0.85)	58.9
Swine	3.59	19.58	1.65	0.20	0.01 (0.10)	24.9
Horses	1.00	0.82	0.41	6.92	0.76 (3.52)	6.4
Poultry	0.00	2.63	1.77	0.12	0.01 (0.06)	4.5
Sheep	2.12	0.08	0.34	0.51	0.04 (0.26)	2.8
Goats	0.27	0.02	0.02	0.39	0.02 (0.20)	0.5
Total	140.8	45.0	17.1	61.7	2.85 (31.4)	236.2

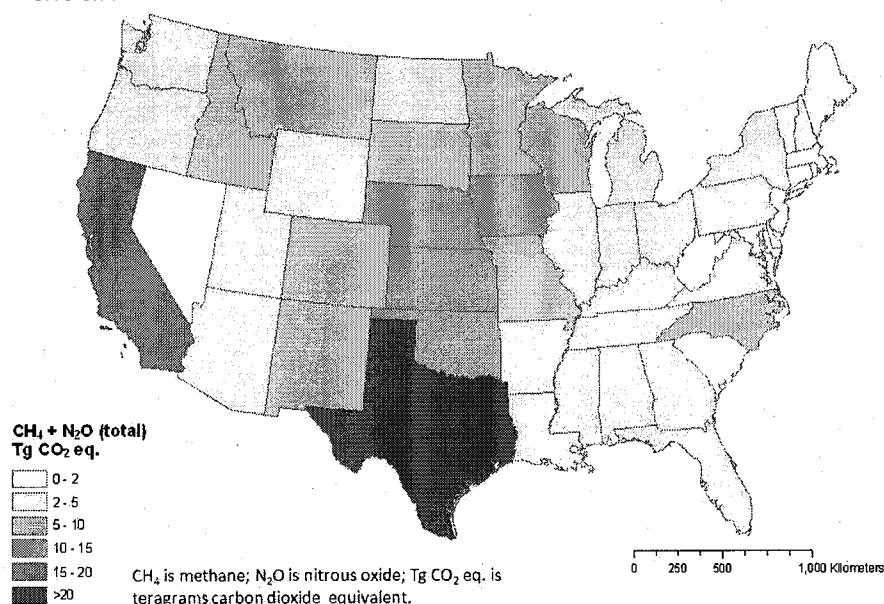
Note: Parentheses indicate a net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide; CO₂ is carbon dioxide.

¹Includes direct and indirect emissions.

Livestock contribute GHGs to the atmosphere both directly and indirectly. Livestock emit CH₄ directly as a byproduct of digestion through a process called enteric fermentation. In addition, livestock manure and urine ("waste") cause CH₄ and N₂O emissions to the atmosphere through increased decomposition and nitrification/denitrification. Managed waste that is collected and stored emits CH₄ and N₂O. Grazing animals influence soil processes (nitrification/denitrification) that result in N₂O emissions from the nitrogen (N) in their waste, which increases N₂O emissions. Forage legumes on grazed lands also contribute to N₂O emissions because legumes fix nitrogen from the atmosphere which can become mineralized in the soil and contribute to nitrification and denitrification. Grazed lands can also act as a source or sink for atmospheric carbon dioxide (CO₂), depending on whether carbon inputs to the soil from plant residues and manure exceed carbon losses from decomposition of soil organic matter. Soils that have been historically cropped using conventional tillage are often depleted of carbon because tillage disturbs soil aggregates and warms soil, both of which increase decomposition rates. Carbon depleted soils can act as CO₂ sinks upon conversion to grazing because grazed soils are typically not plowed. Factors such as grazing intensity and weather patterns also influence net CO₂ fluxes, so a particular parcel of grazed land may be a net source or sink of carbon during any given year.

This chapter provides national and state-level data on CH₄ emissions from enteric fermentation, CH₄ and N₂O emissions from managed livestock waste, and CO₂, N₂O and CH₄ fluxes for grazed lands. Emissions associated with waste applied to grazed land are included in this chapter, while nitrous oxide emissions from managed livestock waste applied to cropped soils are included in the Cropland Agriculture chapter (Chapter 3). State-level livestock population data also are presented in this chapter because GHG emissions from

Map 2-1
GHG emissions from livestock in 2008.



lands. Emissions associated with waste applied to grazed land are included in this chapter, while nitrous oxide emissions from managed livestock waste applied to cropped soils are included in the Cropland Agriculture chapter (Chapter 3). State-level livestock population data also are presented in this chapter because GHG emissions from

livestock are related to livestock population sizes.

2.2 Sources of Greenhouse Gas Emissions from Livestock

The mechanisms and important factors in generating GHG fluxes from livestock, waste management, and grazed lands are detailed below.

2.2.1 Enteric Fermentation

Enteric fermentation is a normal digestive process where anaerobic microbial populations in the digestive tract ferment food and produce CH₄ gas as a byproduct. Methane is then emitted from the animal to the atmosphere through exhaling or eructation. Ruminant livestock, including cattle, sheep, and goats, have greater rates of enteric fermentation because of their unique digestive system, which includes a large rumen or fore-stomach where enteric fermentation takes place. Non-ruminant livestock such as swine, horses, and mules produce less CH₄ from enteric fermentation because it takes place in the large intestine, which has a smaller capacity to produce CH₄ than the rumen. The energy content and quantity of animal feed also affect the amount of CH₄ produced in enteric fermentation, with lower quality and higher quantities of feed causing greater emissions.

2.2.2 Managed Livestock Waste

Livestock waste can be “managed” in storage and treatment systems, or spread on fields in lieu of long-term storage. Alternatively, livestock waste is termed “unmanaged” when it is deposited directly on grazed lands and not transported. Many livestock producers in the U.S. manage livestock waste in systems such as solid storage, dry lots, liquid-slurry storage, deep pit storage, and anaerobic lagoons. Table 2-3 provides descriptions of managed and unmanaged pathways for livestock waste, indicating the relative impacts of different pathways on GHG emissions. Sometimes livestock waste that is stored and treated is subsequently applied as a nutrient amendment to agricultural soils. GHG emissions from the application of treated waste to cropped soils as a nutrient amendment are discussed in the next chapter along with GHG emissions from other nutrient amendments for crop production.

Table 2-3 Descriptions of Livestock Waste Deposition and Storage Pathways

Manure Management System	Description	Relative Emissions	
		CH ₄	N ₂ O
Pasture / Range / Paddock	Manure and urine from pasture and range grazing animals is deposited directly onto the soil.	low	high
Daily Spread	Manure and urine are collected and spread on fields, there is little or no storage of the manure/urine before it is applied to soils.	low	zero ¹
Solid Storage	Manure and urine (with or without litter) are collected by some means and placed under long-term bulk storage.	low	high
Dry Lot	Manure and urine are deposited directly onto unpaved feedlots where the manure is allowed to dry and it is periodically removed (after removal it is sometime spread onto fields).	low	high
Liquid / Slurry	Manure and urine are collected and transported in a liquid state to tanks for storage. The liquid/slurry mixture may be stored for a long-time and water may be added to facilitate handling.	moderate to high	low
Anaerobic Lagoon	Manure and urine are collected using a flush system and transported to lagoons for storage. Manure/urine resides in lagoons for 30-200 days.	variable	low
Pit Storage	Combined storage of manure and urine in pits below livestock confinements.	moderate to high	low
Poultry with Litter	Enclosed poultry houses use bedding derived from wood shavings, chopped straw, or other products depending on availability. The bedding absorbs moisture and dilutes manure. Litter is cleaned out once a year. This system is used for breeder flocks and meat chickens (broilers) and other fowl.	low	high
Poultry without Litter	In high-rise cages or scrape-out/belt systems, manure is excreted onto the floor below with no bedding to absorb moisture. The ventilation system dries the manure as it is stored. This high-rise system is a form of passive windrow composting.	low	low

Adapted from IPCC (2000) Chapter 4. CH₄ is methane; N₂O is nitrous oxide.

¹N₂O emissions are assumed to be zero during the transport/storage phase but not after the waste has been applied to soils.

The magnitude of CH₄ and N₂O emissions from managed livestock waste depends in large part on environmental conditions. Methane is emitted under anaerobic conditions, when oxygen is not

available to the bacteria which decompose waste. Storage in ponds, tanks, or pits such as those that are coupled with liquid/slurry flushing systems often promote anaerobic conditions (i.e., where oxygen is not available and CH_4 is produced), whereas solid waste stored in stacks or shallow dry pits tends to provide aerobic conditions (i.e., where oxygen is available and little or no CH_4 is produced). High temperatures generally accelerate the rate of decomposition of organic compounds in waste, increasing CH_4 emissions under anaerobic conditions. In addition, longer residency time in a storage system can increase CH_4 production, and moisture additions, particularly in solid storage systems that normally experience aerobic conditions, can amplify CH_4 emissions.

While environmental conditions are important factors affecting CH_4 emissions from the management of livestock waste, diet and feed characteristics are also influential. Livestock feed refers to the mixture of grains, hay and byproducts from processed foods that is fed to animals at feedlots and supplemental feed for grazing animals, while diet includes the mixture of plants that animals graze. Livestock feed, diet, and growth rates affect both the amount and quality of manure. Not only do greater amounts of manure lead to higher CH_4 production, but higher energy feed also produces manure with more volatile solids, increasing the substrate from which CH_4 is produced. However, this impact is somewhat offset because some higher energy feeds are more digestible than lower quality forages, and thus less waste is excreted.

The production of N_2O from managed livestock waste depends on the composition of the waste, the type of bacteria involved, and the conditions following excretion. For N_2O emissions to occur, the waste must first be handled aerobically where ammonia or organic nitrogen is converted to nitrates and nitrites (nitrification), and if conditions become sufficiently anaerobic, nitrates and nitrites can be denitrified, i.e., reduced to N oxides and nitrogen gas (N_2) (Groffman et al. 2000). Nitrous oxide is produced as an intermediate product of both nitrification and denitrification and can be directly emitted from soil as a result of both of these processes. These emissions are most likely to occur in dry waste handling systems that have aerobic conditions, but that also contain pockets of anaerobic conditions due to high water contents and high oxygen gas (O_2) demand from decomposition. For example, waste in dry lots is deposited on soil, is oxidized to nitrite and nitrate, and encounters anaerobic conditions following precipitation events that increase water content, enhance decomposition, and deplete the supply of O_2 .

Managed livestock waste can also contribute to indirect N_2O emissions. Indirect emissions result from nitrogen that was emitted or leached from the manure management system in a form other than N_2O and was then converted to N_2O offsite. These sources of indirect N_2O emission from animal waste are from ammonia (NH_3) volatilization, nitric oxide (NO) emissions from nitrification and denitrification, and nitrate (NO_3) leached or run off into ground or surface waters. The gaseous losses of NH_3 and NO to the atmosphere can then be deposited to the soil and converted to N_2O by nitrification. The nitrate leached or run off into waterways can be converted to N_2O by aquatic denitrification.

2.2.3 Grazed Lands

Nitrous oxide from soils is the primary GHG associated with grazed lands. Grazed lands contribute to N_2O emissions by adding nitrogen to soils from animal wastes and from forage

legumes. Legumes fix atmospheric N_2 into forms that can be used by plants and by soil microbes. Nitrogen from manure and legumes is cycled into the soil and can provide substrates for nitrification and denitrification. Nitrous oxide is a by-product of this cycle; thus more nitrogen added to soils yields more N_2O released to the atmosphere. A portion of the nitrogen cycled within the plant-animal-soil system volatilizes to the atmosphere in various gaseous forms and is eventually re-deposited onto the soils where it can contribute to indirect N_2O emissions. Some nitrogen in the form of nitrate can leach into groundwater and surface runoff, undergo denitrification, and contribute to indirect N_2O emissions. In addition to nitrogen additions, weather, soil type, grazing intensity and other factors influence emissions from grazed lands.

Manure deposited on grazed lands also produces CH_4 emissions. Methane emissions from this source are relatively small, less than 3% of total grazed land GHG emissions, because of the predominately aerobic conditions that exist on most pastures and ranges.

Grazed lands can be emission sources or net sinks for CO_2 . Typically, cropland that has recently been converted to grazed land stores CO_2 from the atmosphere in the form of soil organic carbon. But after sufficient time, soil organic carbon reaches a steady state, given consistent weather patterns. Long-term soil carbon levels are sensitive to climate change and soils that were previously sinks can revert to being sources of CO_2 .

2.3 U.S. Livestock Populations

Greenhouse gas emissions from livestock are related to population size. Livestock population data are collected annually by USDA's National Agricultural Statistics Service (NASS). Those data are an input into the GHG estimates from livestock in the U.S. GHG Inventory.

Beef and dairy cattle, swine, sheep, goats, poultry, and horses are raised throughout the United States. Detailed livestock population numbers for each state in 2008 are provided in Appendix Table A-1. Appendix Table A-2 shows total national livestock population sizes from 1990 to 2008 by livestock categories. Trends for beef cattle, dairy cattle, and swine are described in more detail below because of their relatively high population numbers and consequently high contributions to GHG emissions.

Texas raised by far the most beef cattle, at over 14 million head in 2008 (Appendix Table A-1). Kansas, Nebraska, Oklahoma, Iowa, and Missouri each raised from 4 to 6 million head of beef cattle, while several other states raised approximately (~)2 million head. Fewer dairy cattle than beef cattle are raised currently in the United States. Dairy cattle populations were highest in California (~2.6 million) and Wisconsin (~1.9 million) (Appendix Table A-1). New York, Idaho, Pennsylvania, and Minnesota had the next largest populations of dairy cattle, ranging from 730,000 to 970,000 head in each state. Most states had fewer than 500,000 head of dairy cattle.

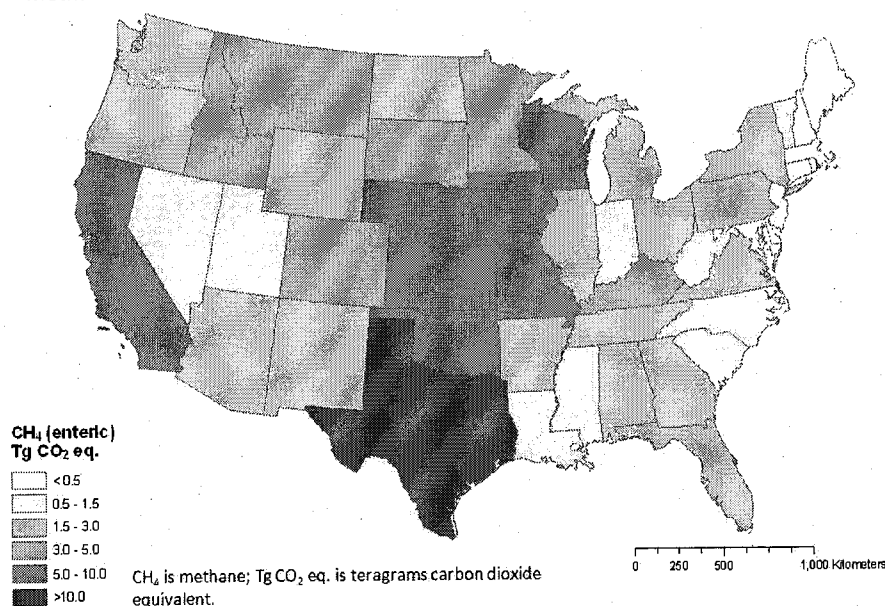
Iowa was the largest swine producer with 19.5 million head in 2008 (Appendix Table A-1). North Carolina housed the second largest swine population at 10 million head. Illinois, Indiana, Minnesota, Missouri, Nebraska, and Oklahoma also have sizeable swine populations.

Arkansas and Georgia had the largest poultry populations in 2008, with roughly 240 million and 280 million head of poultry in each state, respectively (Appendix Table A-1). Alabama, North Carolina, Mississippi, and Texas also had large populations of poultry, between 141 and 209 million head each. Iowa, Indiana, Kentucky, Maryland, and Virginia had poultry populations between 51 and 84 million head.

2.4 Enteric Fermentation

Just over half (53%) of emissions associated with livestock production were from CH₄ produced by enteric fermentation. Cattle were responsible for the vast majority of enteric CH₄ emissions (95%) in 2008 (Table 2-2). Texas (17.9 Tg CO₂ eq.) and California (9.1 Tg CO₂ eq.) had the largest CH₄ emissions from enteric fermentation for beef cattle and dairy cows in 2008 (Map 2-2, Appendix Table A-4). These emissions were largely tied to the sizable populations of cattle in both states. However, enteric fermentation emissions in Texas were mostly from beef cattle, whereas in California they were mostly from dairy cattle (Appendix Table A-4). State-level data for non-cattle livestock (i.e., swine, sheep, goats, and horses) or bulls was not generated due to the relatively low contributions of these animals to total enteric emissions. Central, Northern Plains, and some Great Lakes states also had relatively high CH₄ emissions from enteric fermentation, ranging between 3 and 8.5 Tg CO₂ eq. per state in 2008 (Appendix Table A-4). Emissions tended to be

Map 2-2
Methane emissions from enteric fermentation in 2008.



lower from some states in the Northeast, Southeast, and the desert Southwest, mainly because cattle populations are low in these states.

Annual emissions of CH₄ from enteric fermentation fluctuated by approximately 10 Tg CO₂ eq. between 1990 and 2008 (Table 2-4). Emissions peaked in 1995, then decreased by

about 10 Tg CO₂ eq. by 2005 and were back up near 1995 emissions by 2008. Overall, by 2008, CH₄ emissions from enteric fermentation increased by about 6% compared to 1990 levels.

2.4.1 Methods for Estimating Methane Emissions from Enteric Fermentation

The official U.S. GHG Inventory estimates for enteric fermentation are calculated according to the methodological framework provided by the Intergovernmental Panel on Climate Change (IPCC) for preparing national GHG inventories. The IPCC guidance is

Table 2-4 U.S. Methane Emissions from Enteric Fermentation in 1990, 1995, 2000-2008

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Animal Type	Tg CO ₂ eq.										
Beef cattle	94.5	107.7	100.6	99.9	100.0	100.0	98.3	99.3	100.9	101.6	100.8
Dairy cattle	32.0	30.5	30.9	30.7	30.8	28.7	30.1	30.6	31.3	32.7	33.1
Horses	1.9	1.9	2.0	2.1	2.3	2.6	3.0	3.5	3.6	3.6	3.6
Sheep	1.9	1.5	1.2	1.2	1.1	1.1	1.0	1.0	1.0	1.0	1.0
Swine	1.7	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.1	2.1
Goats	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	132.4	143.7	136.8	136.0	136.3	134.5	134.6	136.7	139.0	141.2	140.8

Tg CO₂ eq. is teragrams carbon dioxide equivalent.

organized into a hierarchical, tiered analytical structure, in which higher tiers correspond to more complex and detailed methodologies. The methods detailed below correspond to both Tier 1 and Tier 2 approaches. With the permission of EPA, Annex 3.9 from the official U.S. GHG Inventory is summarized below. Methane emissions from enteric fermentation were estimated for five livestock categories: cattle, horses, sheep, swine, and goats. Emissions from cattle represent the majority of U.S. emissions; consequently, the more detailed IPCC Tier 2 methodology was used to estimate emissions from cattle, and the IPCC Tier 1 methodology was used to estimate emissions from the other types of livestock.

2.4.1.1 Estimating Methane Emissions from Cattle

This section describes the process used to estimate enteric fermentation emissions of CH₄ from cattle on a regional basis. A Cattle Enteric Fermentation Model (CEFM) based on recommendations provided in IPCC (2006, 1997) was developed that uses information on population, energy requirements, digestible energy, and the fraction of energy converted to methane to estimate CH₄ emissions. The emission estimation methodology consists of the following three steps: (1) characterize the cattle population to account for cattle population categories with different emissions profiles; (2) characterize cattle diets to generate information needed to estimate emissions factors; and (3) estimate emissions using these data and the IPCC Tier 2 equations.

Step 1: Characterize U.S. Cattle Population

Each stage in the cattle lifecycle was modeled to simulate the cattle population from birth to slaughter. This level of detail accounts for the variability in CH₄ emissions associated with each life stage. Given that the time in which cattle can be in a stage can be less than 1 year (e.g., beef calves are weaned at 7 months), the stages are modeled on a per-month basis. The type of cattle

use also impacts CH₄ emissions (e.g., beef versus dairy). Consequently, cattle life stages were modeled for several categories of dairy and beef cattle. These categories are listed in Appendix Table A-5.

The key variables tracked for each of these cattle population categories¹ includes calving rates, pregnancy and lactation (Appendix Table A-6), average weights and weight gains (Appendix Table A-7), feedlot placements (Appendix Table A-8), death rates, number of animals per category each month, and animal characteristics (i.e., age, gender, etc.) data.

Cattle population data were taken from USDA National Agricultural Statistics Service (NASS) (Appendix Table A-2). The USDA NASS publishes monthly, annual, and multi-year livestock population and production estimates. Multi-year reports include revisions to earlier published data. Cattle and calf populations, feedlot placement statistics (e.g., number of animals placed in feedlots by weight class), slaughter numbers, and lactation data were obtained from the USDA NASS (Cattle: USDA NASS 2004, 1999). Beef calf birth percentages were obtained from the USDA Animal and Plant Health Inspection Service (APHIS) National Animal Health Monitoring System (USDA APHIS NAHMS 2008, 1997).

Step 2: Characterize U.S. Cattle Diets

To support development of digestible energy (DE), the percent of gross energy intake digestible to the animal and CH₄ conversion rate (Y_m) (i.e., the fraction of gross energy converted to CH₄ values for each of the cattle population categories) data were collected on diets considered representative of different regions. For both grazing animals and animals being fed mixed rations, representative regional diets were estimated using information collected from state livestock specialists and from USDA APHIS NAHMS (2008). The data for each of the diets (e.g., proportions of different feed constituents, such as hay or grains) were used to determine chemical composition for use in estimating DE and Y_m for each animal type. Region- and cattle-type-specific estimates for DE and Y_m were developed for the U.S. (Appendix Table A-9). Regions are defined in (Appendix Table A-10). Additional detail on the regional diet characterization is provided in EPA (2010).

Step 3: Estimate Methane Emissions from Cattle

Emissions were estimated in three steps: (a) determine gross energy intake using the IPCC (2006) equations, (b) determine an emissions factor using the DE values and other factors, and (c) sum the daily emissions for each animal type. The necessary data values include:

- Body weight (kg)
- Weight gain (kg/day)
- Net energy for activity (Mj/day)
- Standard reference weight (dairy = 1,324 lbs; beef = 1,195 lbs)
- Milk production (kg/day)

¹ Except bulls. Only end-of-year census population statistics and a national emission factor are used to estimate CH₄ emissions from the bull population.

-
- Milk fat (% of fat in milk = 4)
 - Pregnancy (% of population that is pregnant)
 - DE (% of gross energy intake digestible)
 - Y_m (the fraction of gross energy converted to CH_4)

This process was repeated for each month, and the totals for each subcategory were summed to achieve an emissions estimate for the entire year. The estimates for each of the 10 subcategories of cattle are listed in Appendix Table A-11. The CH_4 emissions for each subcategory were then summed to estimate total emissions from beef cattle and dairy cattle for the entire year. The cattle emissions calculation model estimates emissions on a regional scale. Individual state-level estimates were developed from these regional estimates using the proportion of each cattle population subcategory in the state relative to the population in the region.

2.4.1.2 Emission Estimates From Other Livestock

All livestock population data, except for horses, were taken from USDA NASS (1994) reports (Hogs and pigs; Sheep and goats). Appendix Table A-2 shows the population data for all livestock that were used for estimating all livestock-related emissions. For each animal category, the USDA publishes monthly, annual, and multi-year livestock population and production estimates. Multi-year reports include revisions to earlier published data. Recent reports were obtained from the USDA Economics and Statistics System, while historical data were downloaded from USDA NASS. The Food and Agriculture Organization (FAO) of the United Nations publishes horse population data. These data were accessed from the FAOSTAT database (FAO 2009). National-level emission calculations for other livestock were developed from national population totals. State-level emissions for each livestock type were developed from these national totals based on the proportion of livestock population in each state relative to the national total population for the particular livestock category and by assuming that emissions are proportional to populations. Appendix Table A-12 shows the emission factors used for these other livestock.

2.4.2 Uncertainty in Estimating Methane Emissions from Enteric Fermentation

The following discussion of uncertainty in the enteric fermentation estimates is from the U.S. GHG Inventory (EPA 2010) and reproduced here with permission from EPA.

Uncertainty is estimated using the Monte Carlo Stochastic Simulation technique. Emission factors and animal population data are the primary sources of uncertainty in estimating CH_4 emissions from enteric fermentation. One hundred eighty-five input variables were identified as key input variables for uncertainty analysis (e.g., estimates of births by month, weight gain of animals by age class, and placement of animals into feedlots based on placement statistics and slaughter weight data). The uncertainty associated with these input variables is $\pm 10\%$ or lower. However, the uncertainty for many of the emission factors is over $\pm 20\%$. The overall 95% confidence interval around the estimate of 141 Tg CO_2 eq. ranges from 125 to 166 Tg CO_2 eq. (Table 2-1).

2.4.3 Changes Compared to the 2nd Edition of the USDA GHG Report

There were several important modifications made to the emissions estimates for this edition of the USDA GHG report relative to the previous Inventory (USDA 2008b). Most of the changes involved revising animal population estimates or diet assumptions, or refining the model used to calculate emissions. Heifer and steer stocker populations previously left out of the emissions calculations are now included, and beef, dairy, swine, and horse populations were revised. The FAO horse population estimates increased dramatically between the current and previous Inventory. Enteric fermentation data for bull populations are no longer averaged between January and July because of the high degree of uncertainty related to July estimates, so populations are based solely on January estimates. An adjustment was made to the CEFM to allow feedlot placements for the 700–800 lbs category to use excess animals from the over 800 lbs category if insufficient animals are available to place in a given month at 700–800 lbs. Calf weight at 7 months was adjusted to be equal for all months, as current research indicated that evidence was not sufficient to suggest that calf weight at weaning differs by birth month. Mature weight for beef cows was revised based on annual data collected from 1989 through 2007, as was replacement weight at 15 and 24 months. Mature weight for dairy cows was adjusted to 1,550 for all years, and replacement weight at 15 and 24 months was adjusted accordingly. Monthly weight gain for stockers and coefficients used for calculating the net energy required for maintenance used for lactating cattle were increased.

Methane conversion rate (Y_m) and digestible energy (DE) values for cattle were updated based on model evaluations (Kebreab et al. 2008) and literature values. Feedlot diets were updated based on current survey data from Galvayan and Gleghorn (2001) and Vasconcelos and Galvayan (2007). Further modifications were made to feedlot placement methodology when discrepancies existed between simulated USDA placement data for weight class and number of calculated animals available by weight. The models would account for these differences by pulling available stockers from the higher weight category. If a minimum number of available stockers still could not be reached, animals were pulled from the next lower weight category.

As a result of the changes outlined above, emissions from enteric fermentation increased by approximately 18% on average compared to the previous Inventory (USDA 2008).

2.5 Managed Livestock Waste

Greenhouse gas emissions from managed livestock waste are composed of CH_4 and N_2O from livestock waste storage and treatment and CH_4 emissions from the daily spread of livestock waste. Emissions from these sources are discussed below, with estimates disaggregated spatially and by livestock category where possible. Methane was the predominant GHG emitted from managed livestock waste in 2008, accounting for 72% of 62 Tg CO_2 eq. total emissions from this source (Table 2-5). The remaining 28% of GHG emissions from managed livestock waste was N_2O . Dairy cattle and swine were each responsible for 37% and 36% of total managed waste emissions respectively (Figure 2-2). Poultry (7%) and beef cattle (17%) were also important sources in 2008. For beef cattle, N_2O was the predominate form (75%) of waste emissions. Over time, emissions from managed waste increased by ~40% from 1990 to 2008 (Figure 2-3). Most

of the increase was from higher CH₄ emissions due to the trend of storing more waste in liquid systems and anaerobic lagoons, which facilitate CH₄ production.

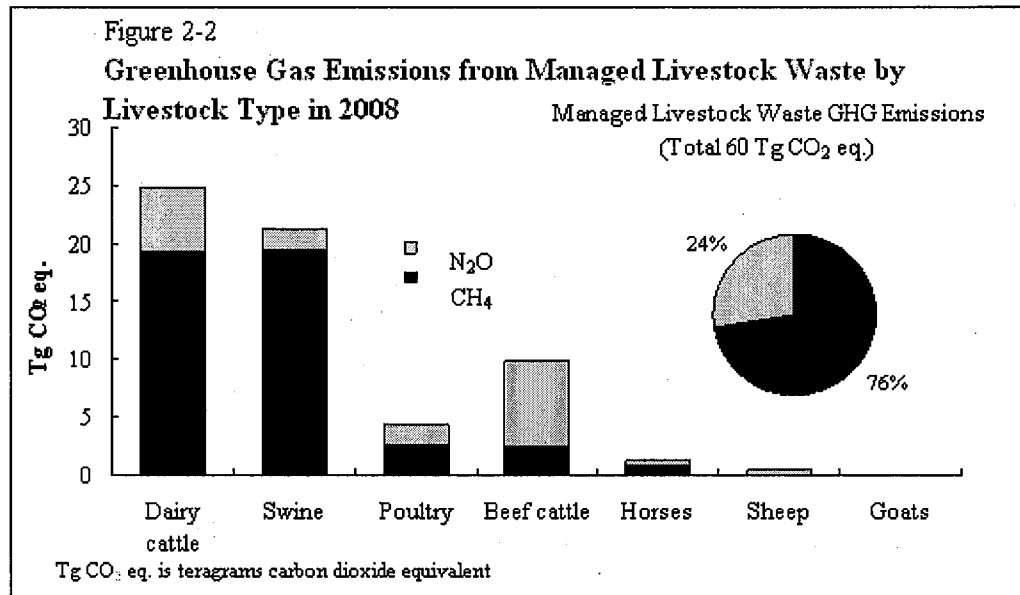


Table 2-5 Greenhouse Gas Emissions from Managed Livestock Waste in 1990, 1995, 2000-2008

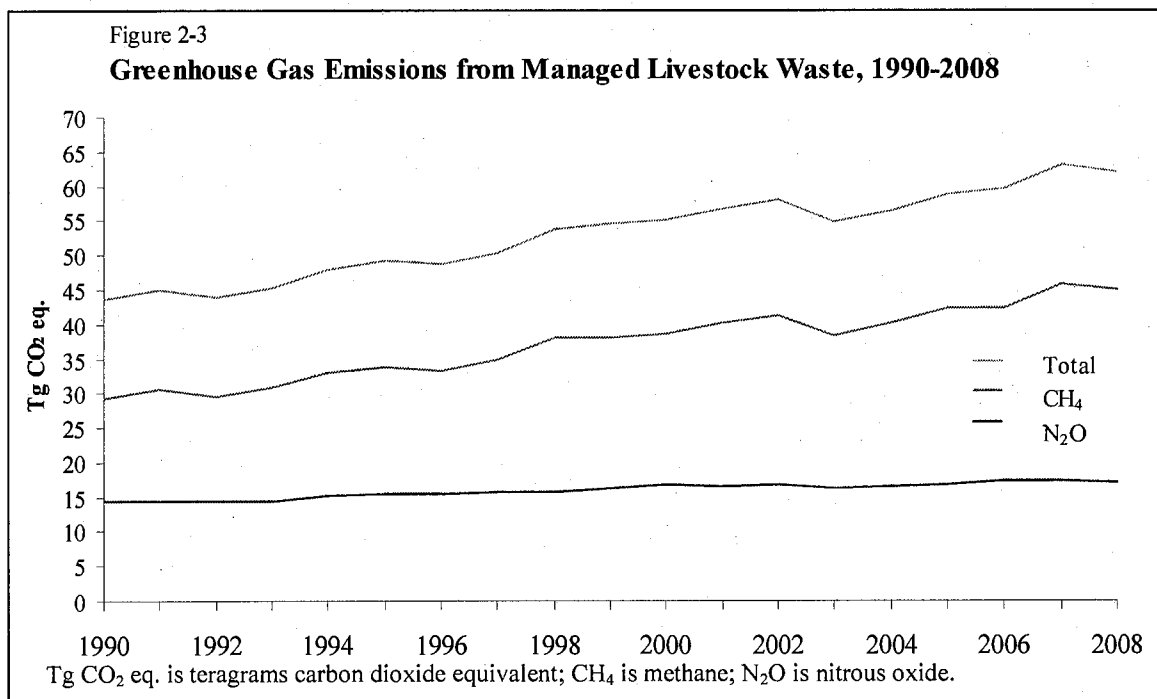
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
GHG Type	<i>Tg CO₂ eq.³</i>										
Nitrous Oxide ¹	14.4	15.5	16.7	16.5	16.8	16.3	16.4	16.6	17.3	17.3	17.1
Methane ²	29.3	33.9	38.6	40.1	41.2	38.4	40.2	42.2	42.3	45.9	45.0
Total	43.7	49.3	55.2	56.6	57.9	54.7	56.5	58.9	59.6	63.2	62.1

¹ Does not include emissions from managed manure applied to cropped soils.

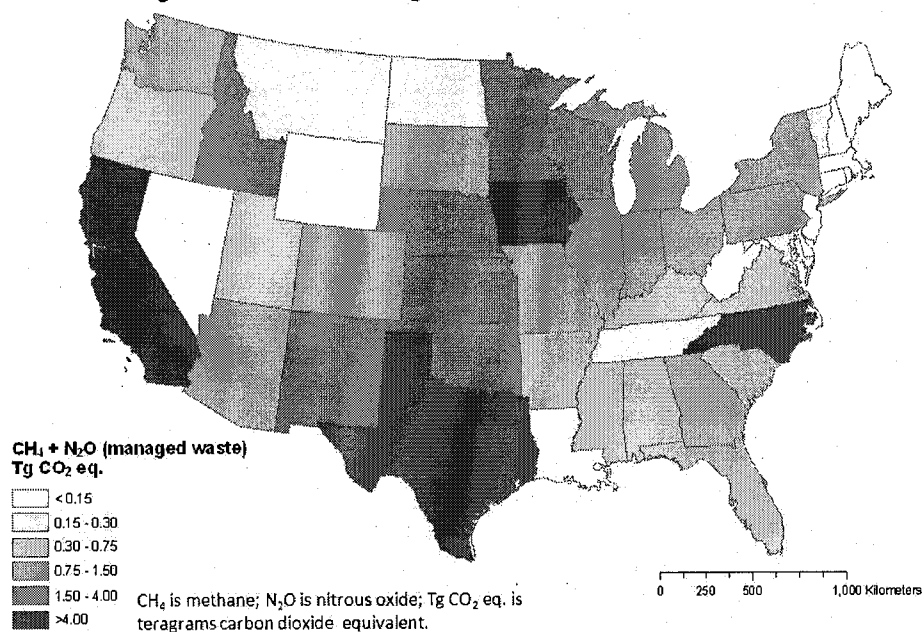
² Includes CH₄ from managed sources and from grazed grasslands. Manure deposited on grasslands produces little CH₄ due to predominantly aerobic conditions

³ Teragrams carbon dioxide equivalent.

While beef cattle are responsible for the largest overall emissions from all livestock, (Table 2-2, Figure 2-1), emissions from beef cattle managed waste are relatively small (Figure 2-2) because most waste generated by beef cattle is unmanaged. Emissions from beef cattle managed manure changed little between 1990 and 2008. Managed manure emissions from horses, sheep, and goats are small due to the relatively small population of these animals (Appendix Table A-2), and, as for beef cattle, most of the manure is unmanaged or managed in dry systems (EPA 2010). State-level GHG emissions from managed livestock waste varied across states in 2008, with a small number of states responsible for the larger contributions to national GHG emissions. California and Iowa had the largest GHG emissions from managed livestock waste (4.8 and 4.6 Tg CO₂ eq., respectively; Map 2-3). In North Carolina, this was primarily from swine. In Texas, however, most emissions were from both beef and dairy cattle waste, with a smaller portion from swine (Appendix Table A-14, A-15).



Map 2-3
Greenhouse gas emissions from managed waste in 2008.



2.5.1 Methods for Estimating Methane and Nitrous Oxide Emissions from Managed Livestock Waste

This section summarizes how CH₄ and N₂O emissions from livestock waste were calculated in the U.S. GHG Inventory (EPA 2010) as well as for this inventory report. Animal population data are used to estimate CH₄ production potential and nitrogen in waste, and these are multiplied by a methane conversion factor (MCF) and direct and indirect N₂O emission factors. MCFs are used to determine the amount of CH₄ emissions that are potentially produced by each unit of livestock waste. MCFs vary by livestock type, manure storage system, and the waste storage temperature. The IPCC (2006) default direct N₂O emission factor was used while indirect N₂O emission factors varied by region and waste management system. The EPA provides the USDA with state and national estimates of GHG emissions from managed livestock waste. The estimates of GHG emissions from managed livestock waste were prepared following a methodology developed by EPA and consistent with international guidance, and are described in detail in Annex 3.10 of the U.S. GHG Inventory (EPA 2010).

Data required to calculate CH₄ emissions from livestock waste:

- Animal population data (by animal type and state);
- Typical Animal Mass (TAM) data (by animal type);
- Portion of manure managed in each Waste Management System (WMS), by state and animal type;
- Volatile solids (VS) production rate (by animal type and state or U.S.);
- CH₄ producing potential (Bo) of the volatile solids (by animal type);
- Methane Conversion Factors (MCF), the extent to which the CH₄ producing potential is realized for each type of WMS (by state and manure management system, including the impacts of any biogas collection efforts).

Seven livestock types are considered: dairy cattle, beef cattle, swine, sheep, goats, poultry, and horses. For swine and dairy cattle, manure management system usage is determined for different farm size categories using data from the USDA (USDA 2000a, 2000b, 2000c, 1998b, 1996) and EPA (EPA 2002a, 2002b, ERG 2008, 2000). For beef cattle and poultry, manure management system usage is not tied to farm size and is based on other sources (ERG 2008, 2000, USDA 2000d, UEP 1999). For other animal types, manure management system usage is based on previous estimates (EPA 1992).

Appendix Table A-16 presents a summary of the waste characteristics used in the emissions estimates. The method for calculating volatile solids production from beef and dairy cows, heifers, and steers is based on the relationship between animal diet and energy utilization, which is modeled in the enteric fermentation portion of the inventory. Volatile solids content of manure equals the fraction of the diet consumed by cattle that is not digested and thus excreted as fecal material which, when combined with urinary excretions, constitutes manure. Estimations of gross energy intake and digestible energy were used to calculate the indigestible energy per animal unit as gross energy minus digestible energy plus an additional 2% of gross energy for urinary energy excretion per animal unit. This was then converted to volatile solids production

per animal unit using the typical conversion of dietary gross energy to dry organic matter of 20.1 MJ/kg (Garrett & Johnson 1983). Appendix Table A-17 shows volatile solid production rates by state and livestock category.

Methane conversion factors for dry manure management systems were set equal to the default IPCC factors for temperate climates (IPCC 2006). MCFs for liquid slurry, anaerobic lagoon, and deep pit systems were calculated based on the forecast performance of biological systems relative to temperature changes. These calculations account for the following: average monthly ambient temperature, minimum system temperature, the carryover of volatile solids from month to month, and a factor to account for management and design practices that result in loss of volatile solids from lagoon systems. State-level emissions factors for liquid slurry, deep pit, and anaerobic lagoon are shown in Appendix Table A-18. Appendix Table A-19 has national-scale emission factors for other waste management systems. For each animal type, the base emission factors were weighted to incorporate the distribution of waste management systems within each state to get a state-level weighted emission factor (Appendix Table A-20).

Methane emissions were estimated by multiplying regional or national animal type-specific volatile solid production by the animal type-specific maximum CH₄ production capacity of the waste and the state-specific MCF.

The following inputs were used in the calculation of direct and indirect N₂O emissions:

- Animal population data (by animal type and state);
- TAM data (by animal type);
- Portion of manure managed in each WMS (by state and animal type);
- Total Kjeldahl N excretion rate (Nex);
- Direct N₂O emission factor (EFWMS);
- Indirect N₂O emission factor for volatilization (EFvolatilization);
- Indirect N₂O emission factor for runoff and leaching (EFRunoff/leach);
- Fraction of N loss from volatilization of ammonia and NO_x (Fracgas);
- Fraction of N loss from runoff and leaching (Fracrunoff/leach)

N₂O emissions were estimated by first determining activity data, including animal population, typical animal mass (TAM), WMS usage, and waste characteristics.

N₂O emissions factors for all manure management systems were set equal to the default IPCC (2006) factors for temperate climates (Appendix A-19).

- Nex rates for all cattle except for bull and calves were calculated for each state and animal type in the Cattle Enteric Fermentation Model (CEFM), which is described in section 6.1, Enteric Fermentation and in more detail in Annex 3.9, Methodology for Estimating CH₄ Emissions from Enteric Fermentation. Nex rates for all other animals were determined using data from USDA's Agricultural Waste Management Field Handbook (USDA 1996) and data from the American Society of Agricultural Engineers, Standard D384.1 (ASAE 2003).

-
- All N₂O emissions factors (direct and indirect) were taken from IPCC (IPCC 2006).
 - Country-specific estimates were developed for the fraction of N loss from volatilization (Fracgas) and runoff and leaching (Fracrunoff/leach). Fracgas values were based on WMS-specific volatilization values as estimated from U.S. EPA's *National Emission Inventory - Ammonia Emissions from Animal Agriculture Operations* (EPA 2005). Fracrunoff/leaching values were based on regional cattle runoff data from EPA's Office of Water (EPA 2002b; see Table A-9 in Annex 3.1).

To estimate N₂O emissions, first, the amount of N excreted (kg per year) in manure in each WMS for each animal type, state, and year was calculated. The population (head) for each state and animal was multiplied by TAM (kg animal mass per head) divided by 1,000, the N excretion rate (N_{ex}, in kg N per 1000 kg animal mass per day), WMS distribution (percent), and the number of days per year.

Direct N₂O emissions were calculated by multiplying the amount of N_{ex} (kg per year) in each WMS by the N₂O direct emission factor for that WMS (EF_{WMS}, in kg N₂O-N per kg N) and the conversion factor of N₂O-N to N₂O. These emissions were summed over state, animal and WMS to determine the total direct N₂O emissions (kg of N₂O per year).

Then, indirect N₂O emissions from volatilization (kg N₂O per year) were calculated by multiplying the amount of N excreted (kg per year) in each WMS by the fraction of N lost through volatilization (Frac_{gas}) divided by 100, and the emission factor for volatilization (EF_{volatilization} in kg N₂O per kg N), and the conversion factor of N₂O-N to N₂O. Next, indirect N₂O emissions from runoff and leaching (kg N₂O per year) were calculated by multiplying the amount of N excreted (kg per year) in each WMS by the fraction of N lost through runoff and leaching (Frac_{runoff/leach}) divided by 100, and the emission factor for runoff and leaching (EF_{runoff/leach} in kg N₂O per kg N), and the conversion factor of N₂O-N to N₂O. The indirect N₂O emissions from volatilization and runoff and leaching were summed to determine the total indirect N₂O emissions.

2.5.2 Uncertainty in Estimating Methane and Nitrous Oxide Emissions from Managed Livestock Waste

The following discussion of uncertainty in estimating GHG emissions from livestock waste is modified from information provided in the U.S. GHG Inventory (EPA 2010, 2007, 2003). The information is reproduced here with permission from EPA.

An uncertainty analysis based on the Monte Carlo Stochastic Simulation technique was conducted on the manure management inventory considering the issues described below and based on published data from scientific and statistical literature, the IPCC, and experts in the industry. The results of the uncertainty analysis showed that the manure management CH₄ inventory has a 95% confidence interval from 39 to 57 Tg CO₂ eq. around the inventory value of 48 Tg CO₂ eq., and the manure management N₂O inventory has a 95% confidence interval from 12 to 18 Tg CO₂ eq. around the inventory value of 14 Tg CO₂ eq (Table 2-1).

Uncertainties derive from limited information on regional patterns in the use of manure management systems and CH₄-generating characteristics of each system. It is assumed that shifts in the swine and dairy sectors toward larger farms causes more manure to be managed in liquid manure management systems. Farm-size data from 1992, 1997 and 2002 are used to modify MCFs based on this assumption. However, the assumption of a direct relationship between farm size and liquid system usage may not apply in all cases and may vary based on geographic location. In addition, the CH₄-generating characteristics of manure management systems are based on relatively few laboratory and field measurements. Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000) published a default range of MCFs for anaerobic lagoon systems of 0% to 100%, reflecting the wide range in performance of these systems globally.

There are potential classification errors when naming manure management systems. For example, many livestock waste treatment systems classified as anaerobic lagoons are actually holding ponds, which may be organically overloaded, thus producing CH₄ at a different rate than estimated. In addition, the performance of manure management systems depends on how they are operated, which undoubtedly varies across facilities. An MCF based on optimized lagoon systems does not take into consideration the actual variation in performance across operational systems. Therefore, an MCF methodology was developed to better match observed system performance and account for the impact of temperature on system performance. The MCF methodology used in the inventory includes a factor to account for management and design practices that result in the loss of volatile solids from the management system. This factor, estimated with data from three systems, all in anaerobic lagoons in temperate climates, was applied broadly to systems across a range of management practices. Additional data are needed on animal waste lagoon systems across the country to verify and refine this methodology. Data are also needed on how lagoon temperatures relate to ambient air temperatures and whether the lower bound estimate of temperature used for lagoons and other liquid systems should be revised. The inventory relies on the IPCC MCF for poultry waste management operations of 1.5%. This factor needs further evaluation to assess if poultry high-rise houses promote sufficient aerobic conditions to warrant a lower MCF.

The default N₂O emission factors published in Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000) were derived using limited information. The IPCC factors are global averages; U.S.-specific emission factors may be significantly different. Manure and urine in anaerobic lagoons and liquid/slurry management systems produce CH₄ at different rates, and would in all likelihood produce N₂O at different rates, although a single N₂O emission factor was used for both system types. In addition, there are little data available to determine the extent to which nitrification and denitrification occur in animal waste management systems. Ammonia concentrations that are present in poultry and swine systems suggest that N₂O emissions from these systems may be lower than predicted by the IPCC default factors. At this time, there are insufficient data available to develop U.S.-specific N₂O emission factors; however, this is an area of ongoing research, and warrants further study as more data become available. Similar approaches will be studied for other animal sub-groups.

Additional data would help confirm and track diet changes over time, which are used to introduce variability in volatile solids for beef and dairy cows, heifers, and steers. A similar approach for swine volatile solids production may improve the accuracy of future inventory estimates. Uncertainty also exists with the maximum CH₄-producing potential of volatile solids excreted by different animal groups. The maximum CH₄-producing values used in the CH₄ calculations are published values for U.S. animal waste. However, there are several studies that provide a range of maximum CH₄-producing values for certain animals, including dairy and swine. The maximum CH₄-producing values chosen for dairy assign separate values for dairy cows and dairy heifers to better represent the feeding regimens of these animal groups. For example, dairy heifers do not receive an abundance of high-energy feed and, consequently, their waste will not produce as much CH₄ as would that from milking cows.

2.5.3 Changes Compared to the 2nd Edition of the USDA GHG Report

There were several changes in the methods used to calculate emissions from managed livestock waste. One of the biggest changes is that the Inventory now includes indirect N₂O emissions in the manure management sector associated with N losses from volatilization of N as ammonia (NH₃), nitrogen oxides (NO_x), and leaching and runoff, as recommended by IPCC (2006). These indirect N₂O emissions are added to the direct N₂O emissions to present a more complete picture of N₂O emissions from manure management. The days per year used in N₂O calculations was changed from 365 to 365.25 to include leap years and to be consistent with the CH₄ inventory calculations. Instead of calculating state weighted average N₂O emission factors and methane conversion factors (MCFs), N₂O and CH₄ emissions are now calculated from the “bottom up” such that CH₄ and N₂O are calculated for each animal group, manure management system, and state. These values are then summed to calculate the total greenhouse gas emissions from manure management in the United States. Animal population data were updated to reflect the final estimates reports from USDA NASS (USDA 1994, 1998a-b, 2000a, 2004, 2005, 2006, 2007). The FAO (2007) horse population estimates for recent years increased dramatically between the current and previous Inventories, resulting in a much larger estimated horse population, and therefore greater greenhouse gas emissions from this source category. On average, annual CH₄ emission estimates are more than those of the previous Inventory by about one percent. Nitrous oxide emission estimates from manure management systems have increased by approximately 60 percent for all years of the current Inventory compared to the previous Inventory mainly due to accounting both direct and indirect N₂O emissions. The most significant changes in N₂O emissions compared to the previous Inventory occurred in the poultry and swine sectors, whose emissions were approximately 70 percent higher due to the inclusion of indirect N₂O emissions.

2.6 Grazed Lands

For the purposes of this report, the term “grazed lands” refers to all lands grazed by livestock regardless of management intensity (i.e., rangeland, pasture, paddock, etc.). Grazed land soils emit N₂O due to enhanced nitrogen cycling as well as a relatively small amount of CH₄ emissions from manure deposits. Manure deposited on grazed land (i.e., unmanaged manure) produces little CH₄ due to predominant aerobic conditions. Nitrous oxide sources include direct and indirect emissions of N₂O associated with increased nitrogen from forage legumes and waste

from grazing animals. Grazed lands can be either a source or a sink of CO₂, depending on the level of soil disturbance and grazing intensity but generally sequester carbon because these lands are not plowed.

Nitrous oxide was the predominant GHG emitted from grazed land soils in 2008, accounting for 96% of all emissions from this source (Table 2-6). The remaining 4% of GHG emissions from grazed lands was CH₄. Grazed lands served as a CO₂ sink in 2008, with an uptake of 31.4 Tg CO₂ eq. via the sequestration of CO₂ into soil organic carbon. Nitrous oxide emissions from grazed land totaled 60.5 Tg CO₂ eq. in 2008 (Table 2-6), including direct and indirect sources. Beef cattle are responsible for the highest proportion of direct N₂O emissions from grazed lands because the vast majority of grazed lands in the U.S. are used for beef production. Texas and Oklahoma had the largest emissions from grazed lands due to the large amounts of rangeland in these states. In aggregate, emissions from grazed lands were roughly four times those of managed manure in 2008 and have been since 1990, when national emissions from this source were first estimated (Tables 2-5, 2-6). This is due to large numbers of beef cattle on grazing land (more than 80% of all cattle) compared to feedlots, which are a source of managed waste (Map 2-4).

Table 2-6 Greenhouse Gas Emissions from Grazed Lands in 1990, 1995, 2000-2008

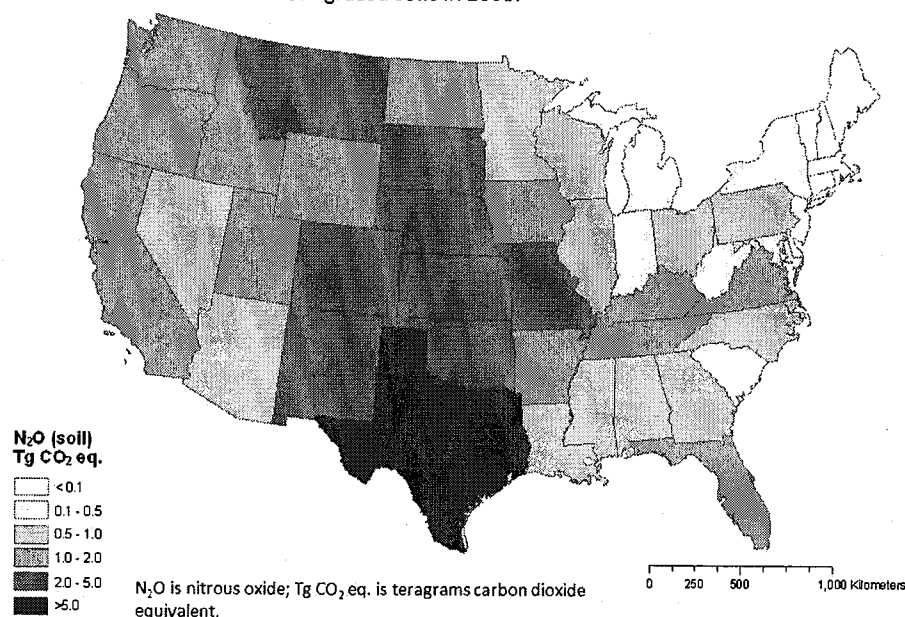
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
GHG Type	Tg CO ₂ eq.										
Nitrous Oxide¹	64.0	62.9	64.2	56.8	58.2	63.9	64.2	59.1	60.1	61.8	60.5
Direct	53.7	53.3	54.5	49.3	50.2	54.1	54.5	49.6	51.2	52.6	51.3
Indirect Volatilization	5.6	5.5	5.6	5.4	5.1	5.3	5.2	5.3	5.3	5.3	5.3
Indirect Leaching & Run-Off	4.8	4.1	4.2	2.0	2.9	4.5	4.4	4.2	3.6	4.0	3.9
Methane²	2.9	3.0	2.7	2.8	2.7	2.7	2.8	2.9	3.0	3.0	2.9
Carbon Dioxide	(69.0)	(58.9)	(83.4)	(57.7)	(71.4)	(31.2)	(31.2)	(31.3)	(31.3)	(31.4)	(31.4)
Grazed Lands											
Remaining Grazed	(46.7)	(36.4)	(51.4)	(27.5)	(43.1)	(4.5)	(4.5)	(4.6)	(4.6)	(4.7)	(4.7)
Land Converted to Grazed Land	(22.3)	(22.5)	(32.0)	(30.2)	(28.3)	(26.7)	(26.7)	(26.7)	(26.7)	(26.7)	(26.7)
Total	(2.1)	6.9	(16.4)	1.8	(10.5)	35.4	35.7	30.7	31.8	33.4	31.9

¹ Does not include emissions from managed manure applied to cropped soils.
Tg CO₂ eq. is teragrams carbon dioxide equivalent.

2.6.1 Methodology to Estimate Nitrous Oxide Emissions from Grazed Lands

Estimates of N₂O emissions from this component were based on DAYCENT model simulations of non-federal grazed lands, estimates of animal waste production (Appendix Table A-21), and IPCC (2006) methodology for emissions from federal grazed lands (EPA 2010). Both managed manure applications and unmanaged manure are considered here. Managed manure is defined as manure that was transported and temporarily stored in a management system before soil application. Unmanaged manure is not managed in manure management systems, but instead remains on soils after being deposited by grazing animals in pastures, rangelands, and paddocks.

Map 2-4
Nitrous oxide emissions from grazed soils in 2008.



The livestock included in this component were dairy cattle, beef cattle, swine, sheep, goats, poultry, and horses.

The DAYCENT ecosystem model simulated improved pastures and rangelands at county-level resolution for non-federal grasslands. Improved pastures are defined as

grazing lands that have either been seeded with legumes and/or amended with organic nitrogen (e.g., managed manure) or synthetic fertilizer nitrogen. Grazing intensity on improved pastures was assumed to be moderate to heavy, while intensity on rangelands was assumed to be light to moderate. Key model inputs are daily weather, soil texture class, vegetation mix, animal waste N inputs, and grazing intensity. The model simulates soil water and temperature flows, plant growth and senescence, decomposition of dead plant material and soil organic matter, mineralization of nutrients, and trace gas fluxes. Nitrous oxide emissions, nitrate (NO_3) leaching, nitrogen volatilization, animal waste deposition, and nitrogen fixation by legumes were simulated on a per unit area basis, and multiplied by the estimated grazed area (NRI USDA 2000b) in each county to obtain total county level nitrogen losses. The DAYCENT simulations are described in more detail in Chapter 3 of this report and in EPA (2010) and Del Grosso et al. (2006). Manure N deposition from grazing animals (i.e., pasture, range and paddock or PRP manure) was an input to the DAYCENT model (see Annex 3.10 EPA 2010), and included approximately 91 percent of total PRP manure. The remainder of the PRP manure N excretions in each county was assumed to be excreted on federal grasslands, and the N_2O emissions were estimated using the IPCC (2006) Tier 1 method with IPCC default emission factors. Waste nitrogen deposited on grazed lands not accounted for by the DAYCENT simulations were multiplied by the default IPCC (2006) emission factor of $0.02 \text{ kg N}_2\text{O-N/kg N}$ to estimate direct N_2O -nitrogen emissions, as opposed to the $0.01 \text{ kg N}_2\text{O-N/kg N}$ used to estimate N additions from managed soils (including mineral fertilizers, organic amendments, crop residues, and N mineralization from soil carbon losses).

The amounts of PRP manure N applied on non-federal and federal grasslands in each county were based on the proportion of non-federal grassland area according to data from the NRI

(USDA 2000b, relative to the area of federal grasslands from the National Land Cover Dataset (Vogelman et al. 2001). Sewage sludge was assumed to be applied on grasslands because of the heavy metal content and other pollutants in human waste that limit its use as an amendment to croplands. Sewage sludge application was estimated from data compiled by EPA (2003), McFarland (2001), and NEBRA (2007).

Indirect N₂O emissions due to volatilization of applied nitrogen and indirect N₂O emissions due to leaching were calculated using DAYCENT and IPCC (2006) estimates of volatilization and NO₃ leaching and IPCC estimates of the portion of volatilized or leached/runoff nitrogen that is converted to N₂O. Nitrogen volatilized, leached, or runoff N are all outputs for the grazed lands simulated by DAYCENT. For animal waste not accounted for by the DAYCENT simulations, 10% of animal waste nitrogen was assumed to volatilize and 30% of animal waste nitrogen was assumed to be leached or runoff. The total volatilized nitrogen was multiplied by the IPCC default emission factor of 0.01 kg N₂O-N/kg N (IPCC 2006). The total nitrogen leached or runoff was multiplied by the IPCC (2006) default emission factor of 0.0075 kg N₂O-N/kg N.

Total grazed land N₂O emissions were partitioned among different animal types by assuming that emissions are linearly proportional to waste nitrogen production.

2.6.2 Uncertainty in Nitrous Oxide Emissions for Grazed Lands

Uncertainty due to model inputs and model structure were quantified. Model inputs used to represent weather, N inputs, and soil texture are not known precisely, and each of these has an associated range of uncertainty represented by a probability density function. Model structural uncertainty refers to the errors inherent in the model. That is, the model is not expected to yield perfect results even if model inputs were precisely known. Combining uncertainties related to model input and model structure yields uncertainty ranges for N₂O in grazed lands that are larger than those reported in the previous Inventory. To address uncertainty in model inputs, a series of Monte Carlo simulations were performed. To address model structural uncertainty, DAYCENT-simulated N₂O emissions were compared with measured emissions from over 10 grassland experiments in North America. IPCC (2006) methodology was used to estimate uncertainties for federal grazed lands not accounted for by the DAYCENT simulations. Uncertainty from the DAYCENT simulated grazed land was combined with uncertainty for remaining grazed lands calculated using IPCC (2006) methodology by using simple error propagation. The calculated 95% confidence interval around the estimate of 62 Tg CO₂ eq. for grazed soil N₂O emissions was 39 to 156 TgCO₂ eq (Table 2-1). Uncertainty calculations are described in detail in Chapter 3 of this report.

2.6.3 Methodology to Estimate Methane Emissions from Grazed Lands

Methane emissions were estimated by multiplying regional or national animal type-specific volatile solid production by the animal type-specific maximum CH₄-production capacity of the waste and the national MCF for manure deposited on grazed lands.

2.6.4 Changes Compared to the 2nd Edition of the USDA GHG Report

In accordance with 2006 IPCC suggested protocol, the N₂O emission factor for grazed land manure associated with horses, sheep, and goats was set to 1 percent. Previously, the 2% emission factor for cattle, swine, and poultry was applied to all livestock categories. In the previous edition, internal calculations in the DAYCENT model were used to derive N additions from unmanaged animal waste. In this edition, these N additions are based on animal population data. This improvement ensures that the data on PRP manure N in the DAYCENT model simulations is consistent with N excretion data from the Managed Livestock Waste section of this Inventory. Another important change relates to indirect emissions from NO₃ leaching. Nitrate leaching was assumed to be an insignificant source of indirect N₂O in grassland systems where the amount of precipitation plus irrigation did not exceed the potential evapotranspiration, as recommended by IPCC (2006). These areas are typically semi-arid to arid, and nitrate leaching to groundwater is a relatively uncommon event. Adopting this recommendation reduced indirect N₂O emissions significantly. In aggregate, these changes resulted in an approximately 40-percent decrease in N₂O emissions from grazed lands on average, primarily due to the new operational version of DAYCENT, revised N additions from grazing animal waste, and reduced impact of NO₃ leaching on indirect N₂O emissions in arid and semi-arid regions.

2.6.5 Methodology to Estimate Carbon Dioxide Fluxes for Grazed Lands

As with N₂O emissions, carbon dioxide (CO₂) fluxes for grasslands were estimated using results from an ecosystem model (CENTURY) and IPCC (2006) methodology. CENTURY (Parton et al. 1994) uses monthly weather data, surface soil texture class, and current and historical vegetation type and land management information to simulate plant growth and senescence, decomposition of dead plant material and soil organic matter, soil water content and temperature, and other ecosystem variables. CENTURY has been parameterized to simulate continuous grasslands and croplands converted to grasslands but not other land uses converted to grasslands. Consequently, IPCC (2006) methodology was used to estimate CO₂ fluxes for land converted from non-agricultural uses to grazed land. Also, CENTURY has not been well tested with organic soils, so IPCC (2006) methodology was also used for grazed organic soils.

Both CENTURY and IPCC (2006) methodologies rely on land use classifications and land use histories. The National Resources Inventory (NRI USDA 2000b) was used to identify grassland remaining grassland and land converted to grassland. Grassland includes pasture and rangeland where the primary land use is livestock grazing. The NRI is a statistically based sample of all non-federal land and includes ~400,000 points in agricultural land. Data have been reported every five years starting in 1982, and 2003 is the most recent year that has been reported. According to NRI data, ~17 million ha of grassland (out of a total ~261 million ha reported in 2003) were converted to grassland between 1997 and 2003. An example of land converted to grassland is land that was cropped historically but then converted to pasture use. Carbon dioxide fluxes for grazed lands were calculated using estimates of changes in soil organic carbon stocks and molecular stoichiometry.

Mineral soil carbon stocks and stock changes for NRI points classified as grasslands remaining grasslands and cropland converted to grassland were estimated using the CENTURY model. In addition to accounting for weather and soil texture, these simulations also included estimates of

managed manure additions to grasslands. Waste from grazing animals deposited directly onto grasslands is calculated by the model based on grazing intensity and forage availability. CENTURY estimates carbon stock changes by accounting for carbon inputs from plant material and manure and carbon outputs from grazing and decomposition. For details on sources of the input data required to run CENTURY and how the simulations were conducted, see Chapter 3 of this report and Chapter 7 and Annex 3.13 of the U.S. GHG Inventory (EPA 2010).

Mineral soil carbon stocks and stock changes for NRI points classified as land other than cropland converted to grassland and all grasslands growing on organic soils were estimated using IPCC (2006, 1997) methodology. U.S.-specific stock change factors based on field data were developed for land converted to grassland and for drained histosols used for grazing. As with grazed land N₂O emissions, CO₂ fluxes were partitioned among different animal types by assuming that fluxes are linearly proportional to waste nitrogen production.

2.6.6 Uncertainty in Carbon Dioxide Fluxes for Grazed Lands

Uncertainty for the estimates of CO₂ fluxes from mineral soil grassland remaining grassland and cropland converted to grassland provided by CENTURY model simulations used a Monte Carlo approach, which addresses uncertainties in model inputs and uncertainties from scaling NRI points to cover all grasslands remaining grassland in the U.S. Uncertainty for estimates from other land uses converted to grassland and all organic soil grasslands provided by IPCC (2006, 1997) methodology used a Monte Carlo approach that addressed uncertainties in carbon stock change factors and in land use data. Uncertainties were combined using simple error propagation, the results yielded an uncertainty of (7) to (3) around the estimate of (5) Tg CO₂ eq. in 2008 for land remaining grazed land and (29) to (24) around the estimate of (27) Tg CO₂ eq. for land converted to grazed land in 2008, where parentheses indicate a net sequestration of CO₂ (Table 2-1).

2.6.7 Changes Compared to the 2nd Edition of the USDA GHG Report

There are several important changes that impacted estimate of carbon dioxide fluxes for grazed lands. Annual survey data from the USDA National Resources Inventory (NRI) were incorporated into this year's Inventory. This resulted in the availability of new data, which extended the time series of activity data beyond 1997 to 2003. In previous Inventories, activity data were only available through 1997 at 5-year intervals, and subsequent years were treated as the same land use practice occurring in 1997. Each NRI point was simulated separately, instead of simulating clusters of points that had common land use histories and soil characteristics in a county as was done previously. NRI area data were reconciled with the forest area estimates in the Forest Inventory and Analysis (FIA) dataset, and were incorporated into the estimation of soil C stock changes. Overall, these changes resulted in an average annual increase in soil C stocks of approximately 40 Tg CO₂ eq. for the time series, compared to the previous Inventory.

2.7 Mitigating Greenhouse Gas Emissions from Livestock

2.7.1 Enteric Fermentation

Emissions of CH₄ from enteric fermentation in ruminant and non-ruminant animals are dependent on the animal's digestive system and the amount and type of feed consumed. On average, beef and dairy cattle convert 6% of gross energy intake from feed into CH₄ through enteric fermentation, constituting a loss of energy from the perspective of the animal (Johnson & Johnson 1995). Research on animal nutrition has focused on reducing this energy loss, which consequently reduces CH₄ emissions and increases nutritional efficiency. Through such research, a number of potential strategies have been identified to reduce CH₄ emissions from enteric fermentation, including (Mosier et al. 1998):

- Increasing the digestibility of forages and feeds;
- Providing feed additives which may tie up hydrogen in the rumen;
- Inhibiting the formation of CH₄ by rumen bacteria;
- Increasing acetic acid in the rumen;
- Improving production efficiency; and
- Modifying bacteria in the rumen.

Currently, government research programs indirectly address mitigation of CH₄ emissions through improved livestock production. Ongoing research development and deployment efforts related to mitigating CH₄ emissions include:

- Decreasing feed digestion time by improving grazing management to increase the digestibility of forages, increasing the digestibility of feed grains, and increasing the feeding of concentrated supplements;
- Adding edible oils in feed to sequester hydrogen making it unavailable for methanogens;
- Using feed additives, ionophores, which inhibit the formation of CH₄ by rumen bacteria;
- Improving livestock production efficiency by feed additives such as hormones to increase milk production and growth regulators for beef production or by improved diet or genetics;
- Enhancing rumen microbes to produce usable products rather than CH₄.

2.7.2 Livestock Waste

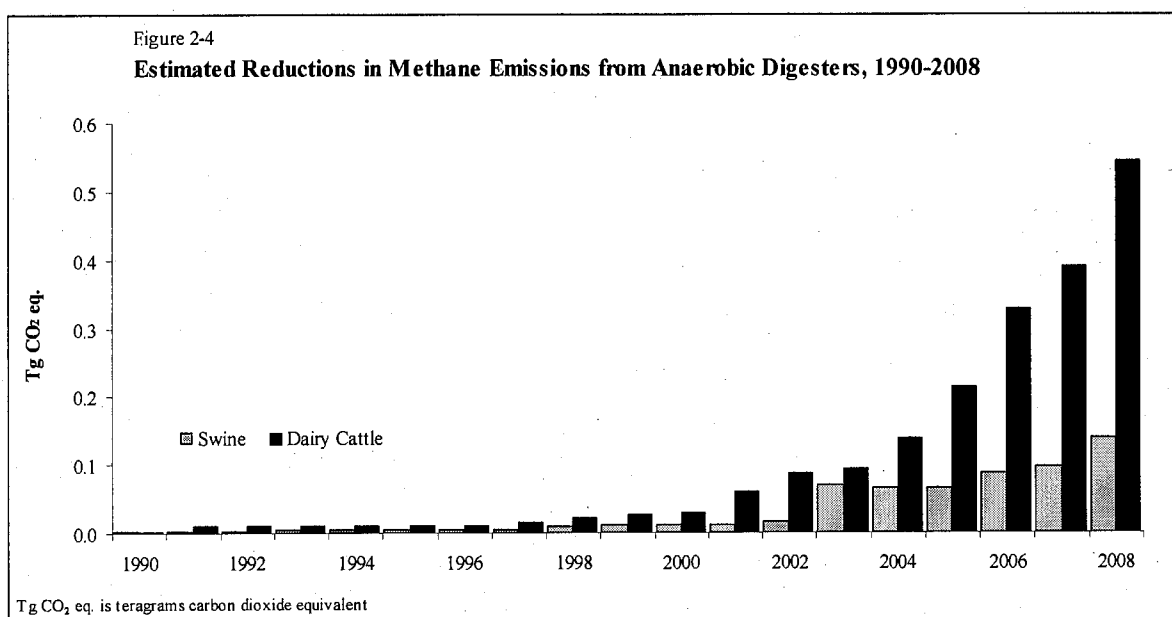
Livestock and poultry waste from production facilities has the potential to produce significant quantities of CH₄ and N₂O, depending on the waste management practices used. In the United States, livestock and poultry manure is managed in a myriad of ways, suggesting there are multiple options for reducing CH₄ and N₂O emissions. When manure is stored or treated in systems that promote anaerobic conditions, such as lagoons and tanks, the decomposition of the biodegradable fraction of the waste tends to produce CH₄. When manure is handled as a solid,

such as in stacks or deposits on pastures, the biodegradable fraction tends to decompose aerobically and produce little or no CH₄, although it produces N₂O.

A relatively large portion of CH₄ is emitted from livestock and poultry waste in anaerobic lagoons. Current, commercially available technologies that have been the most successful in reducing CH₄ emissions from manure management are anaerobic digestion systems. Unlike conventional lagoons, digestion technologies keep waste treatment and storage functions separate and allow for gas recovery and combustion, pathogen and organic stabilization, odor and other air quality pollution control, and flexible approaches to nutrient management.

The EPA tracks installation and usage of anaerobic digesters under voluntary programs such as AgStar (<http://www.epa.gov/agstar/>) and uses this data to estimate how much anaerobic digesters have reduced overall CH₄ emissions from livestock waste over the last 11 years. Figure 2-4 shows an increasing trend in emissions reductions annually from the use of anaerobic digesters, reflecting increasing numbers of digester systems being installed each year.

Other emission reduction processes can include separation, aeration, or shifts to solid handling or storage management systems. These strategies, however, could be limited by other farm or environmental constraints and costs.



2.7.3 Grazed Lands

Nitrous oxide is by far the largest source of emissions from grazed lands so it also provides the largest mitigation potential (Table 2-6). However, because grazed lands are not highly managed, particularly the large expanses of rangeland in the Western U.S., mitigation options are limited.

One strategy that may be feasible for more intensely managed pastures in the Eastern U.S. is nitrification inhibitors. Although synthetic nitrogen fertilizer inputs are low, grazing lands usually have large nitrogen inputs from biological nitrogen fixation because they are seeded with legumes. This mitigation potential has not been quantified but will be in future DAYCENT model simulations.

Recent model simulations indicate grazed lands are currently providing a net sequestration of CO₂ emissions (Table 2-6) and have the potential to store over 100 Tg CO₂ per year across the U.S. (Follett et al. 2001). The largest potential is by decreasing soil erosion and restoring eroded and degraded soils so that they become net carbon sinks. Other management practices which enhance carbon storage include nutrient/manure additions, legume seeding, and improved grazing management. However, the benefits of increased carbon storage must be compared with the costs of increased N₂O emissions associated with nutrient/manure additions and legume seeding.

Chapter 3: Cropland Agriculture

3.1 Summary of U.S. Greenhouse Gas Emissions from Cropland Agriculture

In 2008, cropland agriculture resulted in total emissions of 196 Tg CO₂ eq. of greenhouse gases (GHG) (Table 3-1). Cropland agriculture is responsible for almost half (46%) of all emissions from the agricultural sector (EPA 2010). Nitrous oxide (N₂O), carbon dioxide (CO₂), and methane (CH₄) emissions from cropped soils totaled 154, 34, and 8 Tg CO₂ eq., respectively, in 2008. However, that amount was offset by a storage, or carbon sequestration, of 42 Tg CO₂ eq. in cropped soils in 2008. When carbon sequestration is taken into account, net emissions of GHG from cropland agriculture amount to approximately 154 Tg CO₂ eq. The 95% confidence interval for net emissions in 2008 is estimated to lie between 104 and 246 Tg CO₂ eq. (Table 3-1).

Table 3-1 Estimates and Uncertainties for Cropland Greenhouse Gas Emissions, 2008

Source	GHG Emissions	Lower Bound	Upper Bound	Lower Bound	Upper Bound
		Tg CO ₂ eq.		percent	
N₂O	154	114	241	-26	+57
Soils Direct	118	84	181	-29	+53
Soils Indirect ¹	35	14	96	-59	+173
Residue Burning	1	0	1	-71	+83
CH₄	8	4	19	-57	+127
Residue Burning	1	0	2	-68	+88
Rice Cultivation	7	3	18	-64	+143
CO₂	(8)	(38)	20	-360	+347
Mineral Soils	(42)	(69)	(16)	-63	+63
Organic Soils	30	17	40	-43	+33
Liming of Soils	4	0	8	-97	+102
Total Emissions	196	154	285	-22	+45
Net Emissions²	154	104	246	-33	+60

Note: Parentheses indicate a net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide; CO₂ is carbon dioxide.

¹ Accounts for loss of manure N during transport, treatment and storage, including volatilization and leaching/runoff.

² Includes sources and sinks.

Net emissions in 2008 were 23% higher than the baseline year (1990). Greenhouse gas emissions from agricultural soils fluctuated between 1990 and 2008, with CH₄ and N₂O reaching their highest levels in 2001 (Table 3-2). Net CO₂ flux showed substantial interannual variability, mainly due to fluctuations in the mineral soil CO₂ sink. Annual fluctuations in CO₂ sequestration are primarily a result of variability in weather patterns and land use changes.

Table 3-2 Summary of Greenhouse Gas Emissions from Cropland Agriculture, 1990, 1995, 2000-2008

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Source	Tg CO ₂ eq.										
N₂O	139.5	144.1	151.8	160.2	150.2	147.8	152.4	153.8	150.5	151.2	153.9
Soils Direct	103.0	109.8	115.6	122.3	115.3	111.4	118.5	117.9	114.7	116.7	118.3
Soils Indirect ¹	36.0	33.9	35.7	37.5	34.4	35.9	33.4	35.4	35.3	34.1	35.1
Residue Burning	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
CH₄	7.9	8.4	8.4	8.5	7.6	7.8	8.5	7.8	6.8	7.1	8.2
Residue Burning	0.8	0.7	0.9	0.9	0.8	0.9	1.0	0.9	0.9	1.0	1.0
Rice Cultivation	7.1	7.6	7.5	7.6	6.8	6.9	7.6	6.8	5.9	6.2	7.2
CO₂	(22.6)	(15.6)	(23.5)	(4.3)	(1.7)	(7.2)	(8.3)	(8.0)	(8.9)	(9.2)	(8.3)
Mineral Soils	(57.1)	(50.3)	(58.1)	(39.0)	(37.0)	(42.0)	(42.5)	(42.6)	(43.4)	(44.0)	(42.4)
Organic Soils	29.8	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3
Liming of Soils	4.7	4.4	4.3	4.4	5.0	4.6	3.9	4.3	4.2	4.5	3.8
Total Emissions	181.9	187.2	194.8	203.4	193.1	190.5	195.2	196.2	191.9	193.2	196.2
Net Emissions²	124.8	136.9	136.7	164.5	156.1	148.4	152.7	153.6	148.5	149.2	153.8

Note: Parentheses indicate a net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide; CO₂ is carbon dioxide.

¹ Soils Indirect N₂O emissions account for volatilization and leaching/runoff.

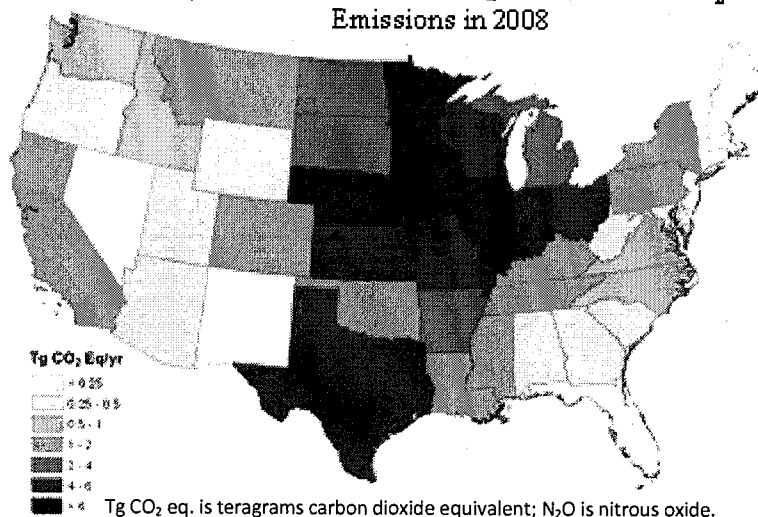
² Includes sources and sinks.

Greenhouse gas emission from agricultural soils, primarily N₂O, were responsible for the majority of total emissions, while CH₄ and N₂O from residue burning and rice cultivation caused about 4% of emissions in 2008 (Tables 3-1, 3-2). Soil CO₂ emissions from cultivation of organic soils (15%) and from liming (2%) are the remaining sources. Nitrous oxide emissions from soils are the largest source in the U.S. because N₂O is a potent greenhouse gas (see Chapter 1 Box 1-1) and due to the large amounts of nitrogen added to crops in fertilizer that stimulate N₂O production. Emissions from residue burning are minor because only ~3% of crop residue is assumed to be burned in the U.S. (EPA 2010). Cropped soils in the U.S. are a net CO₂ sink mainly because reduced tillage

intensity has become more popular in recent years and lands used for perennial hay cropping, as well as idle cropland enrolled in the Conservation Reserve Program (CRP), continue to store carbon.

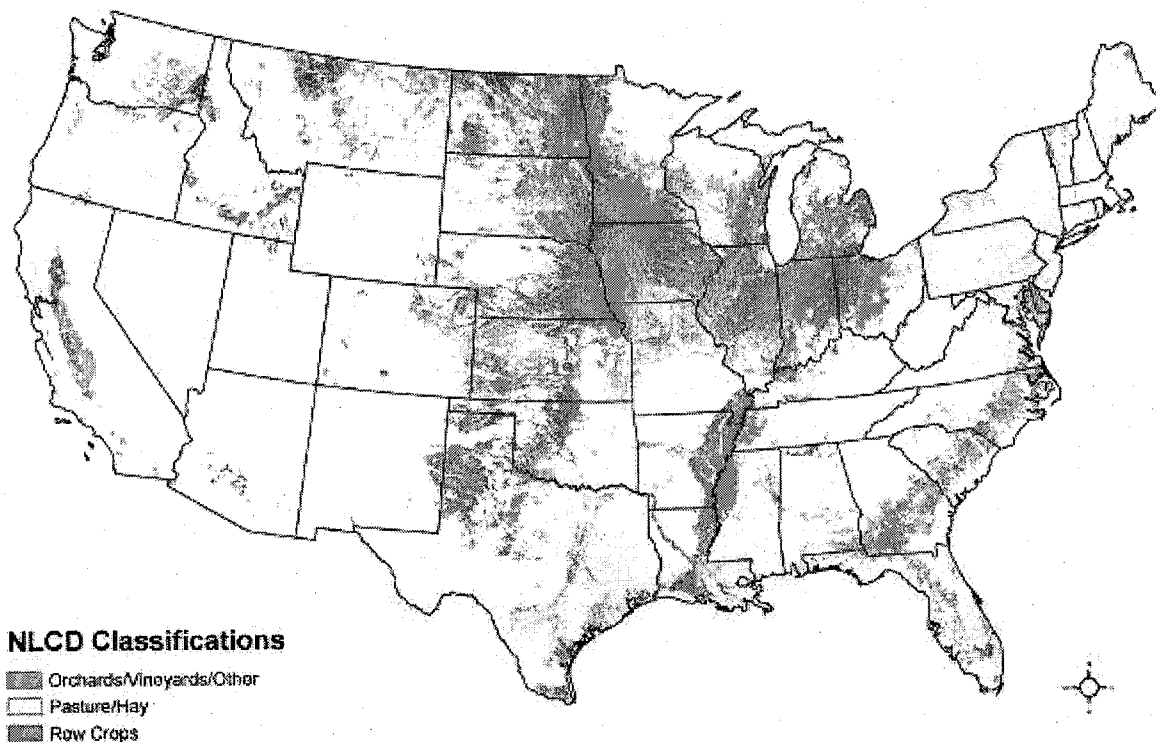
Nitrous oxide emissions were largest in areas where a large portion of land is used for intensive agriculture (Map 3-1). For example, 90% or more of the land in many counties in the Corn Belt is intensively cropped (Map 3-2). Corn is the leading crop for N₂O

Map 3-1 Major Crops, Average Annual Direct N₂O Emissions in 2008



Tg CO₂ eq./yr is teragrams carbon dioxide equivalent; N₂O is nitrous oxide.

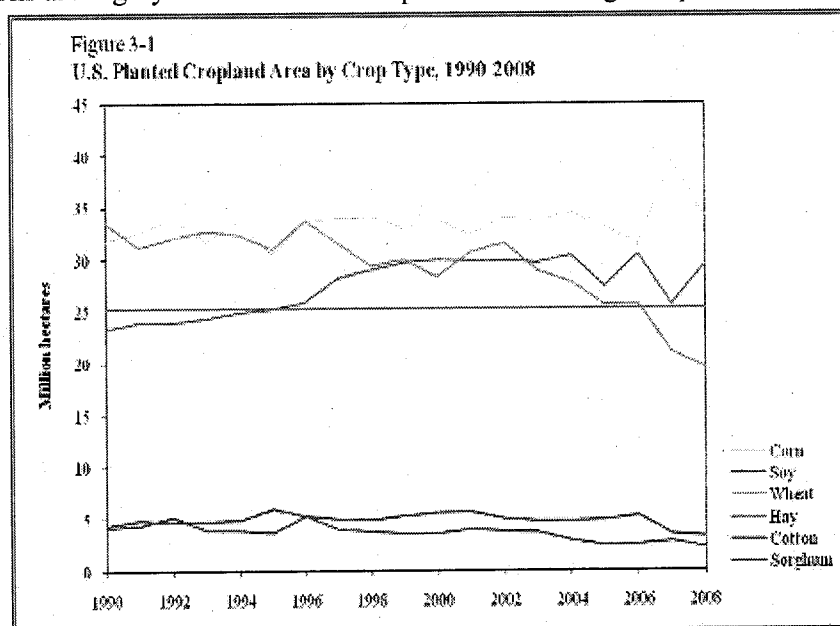
Map 3.2 U.S. Cropped Land



emissions followed by soybean and hay (Table 3-3).

Emissions from corn cropping are high because large amounts of nitrogen (N) fertilizer are routinely applied and the land area used for corn production is the most extensive (Figure 3-1). Although little N fertilizer is applied for soybean cropping, N₂O emissions are high because soybeans supply large amounts of N to the soil from biological fixation of atmospheric nitrogen (N₂). In general, N₂O emissions are highly correlated with crop areas and nitrogen inputs. Biological fixation makes up about half of total N additions, followed by synthetic fertilizer addition and manure (Figure 3-2). Note that Map 3-1 does not include emissions from non-major crops, which make up a significant portion of total emissions in California and Florida. The cropped soil emissions reported here are consistent with those in EPA (2010).

Cropland agriculture results in GHG emissions from multiple sources, with



the magnitude of emissions determined, in part, by land management practices. Application of synthetic and organic fertilizers, cultivation of N fixing crops and rice, cultivation and management of soils, and field burning of crop residues leads to emissions of N_2O , CH_4 , and CO_2 . However, agricultural soils can also mitigate GHG emissions through the biological uptake of organic carbon in soils resulting in CO_2 removals from the atmosphere. This chapter covers both GHG emissions from cropland agriculture and biological uptake of CO_2 in agricultural soils. National estimates of these sources, published in the U.S. GHG Inventory, are reported in this section and, where appropriate, county and state-level emissions estimates are provided.

Sources and sinks of N_2O , CH_4 , and CO_2 and the mechanisms that control fluxes are discussed in detail. Methodologies used to estimate emissions are summarized and mitigation opportunities are discussed and quantified where possible. The methodologies used here are similar to those reported in the second edition of the USDA GHG report (USDA 2008), with some improvements in model algorithms and model input data.

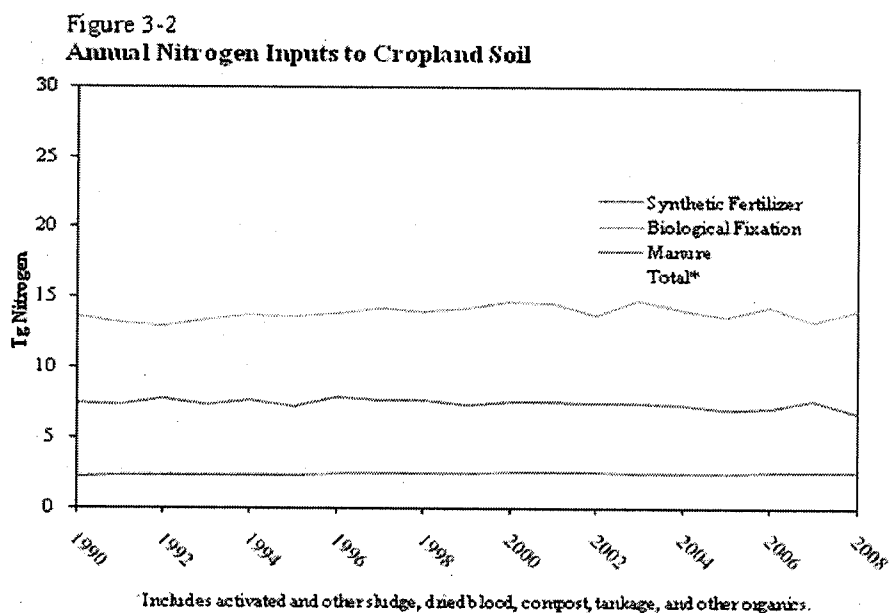


Table 3-3 Nitrous Oxide Emissions from Differently Cropped Soils, 1990, 1995, 2000-2008¹

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Source	Tg CO ₂ eq.										
Corn	47.5	42.8	49.7	53.6	49.3	47.8	51.6	51.6	47.1	59.3	54.0
Direct	36.1	34.8	40.0	42.8	40.3	37.4	42.5	41.7	38.0	48.0	43.7
Volatilization	1.1	1.1	1.3	1.2	1.3	1.2	1.3	1.2	1.2	1.5	1.3
Leaching & Runoff	10.2	6.9	8.3	9.6	7.7	9.2	7.9	8.7	7.8	9.8	9.0
Soybean	23.8	22.2	29.7	33.1	28.7	29.0	29.9	28.7	30.1	25.4	28.8
Direct	17.1	17.7	22.5	24.5	22.0	21.2	22.5	21.6	22.8	19.3	21.8
Volatilization	0.9	0.9	1.2	1.1	1.1	1.1	1.2	1.0	1.1	1.0	1.1
Leaching & Runoff	5.8	3.6	5.9	7.4	5.7	6.6	6.2	6.1	6.2	5.2	5.9
Hay	16.8	16.4	17.5	18.6	16.8	17.2	17.0	17.9	16.8	17.3	17.4
Direct	14.3	13.7	15.4	15.8	14.4	14.6	15.0	15.3	14.7	14.9	15.2
Volatilization	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Leaching & Runoff	2.2	2.4	1.8	2.4	2.1	2.3	1.7	2.3	1.7	2.0	1.9
Wheat	13.0	17.8	10.8	10.7	11.5	11.9	9.9	8.6	10.6	8.7	8.2
Direct	10.1	8.8	8.1	8.3	8.7	7.7	7.9	7.1	7.1	6.4	6.3
Volatilization	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Leaching & Runoff	2.4	8.5	2.3	1.9	2.4	3.8	1.6	1.2	3.1	1.9	1.6
Cotton	3.9	5.5	5.9	5.8	5.4	4.5	4.6	5.3	4.7	3.6	3.4
Direct	3.2	4.1	4.4	4.7	3.9	3.7	3.6	4.2	4.1	2.8	2.6
Volatilization	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Leaching & Runoff	0.6	1.3	1.4	0.9	1.4	0.7	0.9	1.0	0.5	0.8	0.7
Sorghum	2.8	2.2	2.2	2.7	2.5	2.0	1.6	1.5	1.6	1.7	1.9
Direct	2.1	1.8	1.8	2.3	2.0	1.6	1.3	1.2	1.2	1.4	1.5
Volatilization	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Leaching & Runoff	0.7	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.4	0.3	0.4
Non-major crops	18.8	23.4	22.0	21.2	21.5	21.8	23.8	26.0	25.1	20.5	25.7
Direct	14.1	17.6	16.5	16.0	16.3	16.6	18.1	19.7	18.9	15.6	19.5
Volatilization	1.8	2.2	2.2	2.1	2.2	2.1	2.3	2.5	2.5	2.1	2.5
Leaching & Runoff	2.9	3.6	3.3	3.1	3.1	3.1	3.4	3.8	3.7	2.9	3.8
Histosol Cultivation²	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Managed Manure³	9.9	10.8	11.2	11.6	11.6	10.6	11.1	11.3	11.6	11.7	11.6
All Direct	109.8	112.2	122.8	129.0	121.9	116.4	124.8	125.0	121.3	123.0	125.1
All Volatilization	5.0	5.2	5.7	5.5	5.5	5.4	5.7	5.6	5.7	5.3	5.6
All Leaching & Runoff	24.7	26.6	23.4	25.7	22.9	25.9	21.9	23.3	23.4	22.9	23.2
Total	139.5	144.1	151.8	160.2	150.2	147.8	152.4	153.8	150.5	151.2	153.9

Note: Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide; CO₂ is carbon dioxide.

¹ Emissions from residue burning are not included.

² Direct emissions.

³ Accounts for loss of manure N during transport, treatment and storage, including volatilization and leaching/runoff.

3.2 Sources of Greenhouse Gas Emissions in Cropland Agriculture

3.2.1 Cropped Soils

Agricultural soils serve as both a source of GHG and a mechanism to remove CO₂ from the atmosphere. Nitrous oxide, CH₄, and CO₂ emissions and sinks are a function of underlying biochemical processes. Nitrous oxide is produced as an intermediate during nitrification and

denitrification in soils (Firestone & Davidson 1989). In nitrification, soil micro-organisms (“microbes”) convert ammonium (NH_4) to nitrate (NO_3) through aerobic oxidation (IPCC 1996). In denitrification, microbes convert nitrate to nitrogen oxides (NO_x) and dinitrogen gas (N_2) by anaerobic reduction. During nitrification and denitrification, soil microbes release N_2O , which can diffuse from the soil and enter the earth’s atmosphere (IPCC 1996). Cropland soil amendments that add nitrogen to soils drive the production of N_2O by providing additional substrate for nitrification and denitrification. Commercial fertilizer, livestock manure, sewage sludge, cultivation of N-fixing crops, and incorporation of crop residues all add N to soils. In addition, cultivation, particularly of soils high in organic matter (i.e., histosols), enhances mineralization of nitrogen-rich organic matter, making more nitrogen available for nitrification and denitrification (EPA 2010, 2007). Compared to soil N_2O emissions, other GHG sources from croplands are relatively small. Methane gas is produced and emitted primarily from rice paddies. This, however, is responsible only for a small portion of total emissions from cropped soils in the U.S. due to the small land area cropped with rice in this country. Emissions from crop residue burning are also not a large source compared to soils due to the small portion of residues burned in the U.S.

Nitrous oxide is the major GHG emitted from cropland agriculture in the U.S. Nitrogen can be converted to N_2O and emitted directly from agricultural fields (direct emissions), or it can be transported from the field in a form other than N_2O and then converted to N_2O elsewhere (indirect emissions). A major source of indirect N_2O emissions is from nitrate that either leaches into the groundwater or runs off the soil surface and then is converted to N_2O via aquatic denitrification (Del Grosso et al. 2006). A second source of indirect N_2O emissions comes from N that is volatilized to the atmosphere, then is deposited back onto soils, and converted to N_2O (Del Grosso et al. 2006).

The size of CO_2 sources and sinks from soils is related to the amount of organic carbon stored in the soil (IPCC 1996). Changes in soil organic carbon (SOC) content are related to inputs (e.g., atmospheric CO_2 fixed as carbon in plants through photosynthesis) and losses from decomposition of soil organic matter which causes CO_2 emissions (IPCC 1996). The net balance of CO_2 uptake and loss in soils is driven in part by biological processes, which are affected by soil characteristics and climate. In addition, land use and management can affect the net balance of CO_2 through modifying inputs and rates of decomposition (IPCC 1996). Changes in agricultural practices such as clearing, drainage, tillage, crop selection, irrigation, grazing, crop residue management, fertilization, and flooding can modify both organic matter inputs and decomposition, and thereby result in a net flux of CO_2 to or from soils.

Most agricultural soils contain comparatively low amounts of organic carbon as a percentage of total soil mass, typically in the range of 1 to 6 % organic C by weight, and are thus classified as mineral soils (NRCS 1999). However, on an area basis, this amount of carbon typically exceeds that stored in vegetation in most ecosystems (including forests). Historically, conversion of native ecosystems to agricultural uses resulted in large soil carbon losses, as much as 30-50% or more of the C present in the native condition (Haas et al. 1957, Schlesinger 1986, Guo & Gifford 2002, Lal 2004). Presently, after many decades of cultivation, most soils have likely stabilized at lower carbon levels or are increasing their organic matter levels as a result of increasing crop productivity (providing more residues), less intensive tillage, and other improvements in

agricultural management practices (Paustian et al. 1997, Allmaras et al. 2000, Follett 2001). Changes in land-use or management practices that result in increased organic inputs or decreased oxidation of organic matter (e.g., taking cropland out of production, improved crop rotations, cover crops, application of organic amendments and manure, and reduction or elimination of tillage) usually result in a net accumulation of SOC until a new equilibrium is achieved.

Cultivated organic soils, also referred to as histosols, contain more than 12 to 20% organic matter by weight, and constitute a special case (NRCS 1999, Brady & Weil 1999). Organic soils form as a result of water-logged conditions, in which decomposition of plant residue is retarded. When organic soils are drained and cultivated, the rate of decomposition, and hence CO₂ emissions, is greatly accelerated. Due to the depth and richness of the organic layers, carbon loss from cultivated organic soils can continue over long periods of time.

In addition, lime, often added to mineral and organic agricultural soils to reduce acidic conditions, contains carbonate compounds (e.g., limestone and dolomite) that when added to soils release CO₂ through the bicarbonate equilibrium reaction (IPCC 1996).

3.2.2 Rice Cultivation

Rice cultivation is unique because it takes place almost exclusively on flooded fields, including in the U.S. where rice is almost grown entirely on flooded fields (EPA 2010). This water regime causes CH₄ emissions as a result of waterlogged soils restricting oxygen diffusion and creating conditions for anaerobic decomposition of organic matter, facilitated by CH₄ emitting "methanogenic" bacteria (IPCC 1996, Le Mer & Roger 2001). Methane from rice fields reaches the atmosphere in three ways: bubbling up through the soil, diffusion losses from the water surface, and diffusion through the vascular elements of plants (IPCC 1996). Diffusion through plants is considered the primary pathway, with diffusion losses from surface water being the least important process (IPCC 1996). Soil composition, texture, and temperature are important variables affecting CH₄ emissions from rice cultivation, as are the availability of carbon substrate and other nutrients, soil pH, and partial pressure of CH₄ (IPCC 1996). Since U.S. rice acreage is relatively small compared to other crops, CH₄ emissions from rice cultivation are small compared to other cropland agriculture sources (EPA 2007).

3.2.3 Residue Burning

In the U.S., 7-8 million acres of crop residues in fields are burned annually to prepare for cultivation and to control for pests (EPA 2010). While CO₂ is a product of residue combustion, residue burning is not considered a net source of CO₂ to the atmosphere because CO₂ released from burning crop biomass is replaced by uptake of CO₂ in crops growing the following season (IPCC 1996). However, CH₄ and N₂O, also products of residue combustion, are not recycled into crop biomass through biological uptake the following season. Therefore, residue burning is considered a net source of CH₄ and N₂O to the atmosphere. Overall, GHG emissions from field burning of crop residues are comparatively small in the U.S. relative to other countries (EPA 2010).

3.2.4 Agroforestry

Agroforestry practices such as establishing windbreaks and riparian forest buffers represent another potential carbon sink in cropland agriculture. Comprehensive data on agroforestry practices are not available to estimate the current national levels of carbon sequestration from such practices. However, published research studies have estimated the potential agroforestry carbon sink in the U.S. In temperate systems, agroforestry practices store large amounts of carbon (Kort & Turlock 1999, Schroeder 1994), with the potential ranging from 15 to 198 metric tons of carbon per hectare (modal value of 34 metric tons of carbon per hectare) (Dixon 1995). Nair and Nair (2003) estimated that by the year 2025, the potential carbon sequestration of agroforestry in the United States will be 90 million metric tons of carbon per year. There is a need to better quantify and track agroforestry practices nationally, particularly to inform USDA programs like the Conservation Reserve Program, Environmental Quality Incentives Program, and Forest Land Enhancement Program, which may provide incentives to land owners to implement agroforestry.

3.3 Nitrous Oxide Emissions from Cropped Soils

In 2008, 80% of total cropland soil N₂O emissions were direct soil emissions (Table 3-3). Of the 20% of total emissions from indirect N₂O, 81% are from NO₃ leaching/runoff and the remainder are associated with volatilization. Corn cropland has the highest emissions, roughly 35% of the total, followed by soybean and hay (Table 3-3). Emissions are highest from corn because corn covers the largest land area (Figure 3-1) of all crops and synthetic nitrogen inputs with corn are high. Emissions from soybeans are high due to large crop area and high rates of nitrogen fixation. Other factors contributing to high emissions for these crops are: they are grown mostly in the north central region where many of the soils are high in organic matter and some of the soils are poorly drained, both of which enhance denitrification rates. In the previous report, emissions from wheat were third highest, but recent declines in wheat area have resulted in fewer emissions for this particular crop. Emissions from hay cropping are substantial, despite minimal fertilizer N additions, because a large portion of hay includes N-fixing plants (e.g., alfalfa). Emissions from cotton and sorghum are low, as the cropland area for these crops is small compared to the other major crops simulated by DAYCENT. In addition, emissions from sorghum are low because this crop tends to be grown in drier areas in the eastern Great Plains, and cotton is grown mostly in the South, where soils tend to be low in organic matter. Non-major crop types were responsible for ~17% of total emissions in 2008 (Table 3-3). Emissions from histosol cultivation are small (~2% of total) because histosols represent only ~750,000 ha, which is less than 1% of U.S. cropped land.

Nitrous oxide emissions are largely driven by nitrogen additions, weather, and soil physical properties. External nitrogen inputs (i.e., addition of synthetic fertilizers and manure, as well as biological fixation) to cropped soils varied between ~24 and 27 Tg N between 1990 and 2008 (Fig. 3-2), while N₂O emissions varied between 142 and 165 Tg CO₂ eq. (Table 3-3). Variation in N inputs explained roughly 46% of the variability in soil N₂O emissions. Also, the years with highest nitrogen inputs did not necessarily lead to the highest N₂O emissions. This indicates that other factors such as changes in weather patterns strongly influence the annual variability in

estimated N₂O emissions. Specifically, amount and timing of precipitation, temperature patterns, and soil carbon and nitrogen availability interact to control N₂O emissions.

3.3.1 Methods for Estimating N₂O Emissions from Cropped Soils

Emissions of N₂O from nitrogen additions to cropland soils and cultivation of histosol soils are source categories analogous to those covered in Agricultural Soil Management in the U.S. GHG Inventory (EPA 2010), with some exceptions. The U.S. GHG Inventory (EPA 2010) includes in the Agricultural Soils Management section direct emissions of N₂O from livestock on grazed lands, while the USDA GHG Inventory includes this source under Livestock GHG Emissions in Chapter 2 of this report. Also, the U.S. GHG Inventory (EPA 2010) includes in the Agricultural Soils Management section indirect emissions of N₂O from all sources, including indirect N₂O from livestock grazing and from urban areas. For this report, indirect N₂O from grazing is included in the livestock chapter, while indirect emissions from urban areas and other non-agricultural sources are not covered at all.

Briefly, the DAYCENT ecosystem model was used to estimate direct soil N₂O emissions, NO₃ leaching, and nitrogen volatilization from major crop types. IPCC (2006) methodology was used to estimate direct and indirect emissions from cropped soils not included in the DAYCENT simulations and to calculate indirect emissions from DAYCENT estimates of NO₃ leaching and volatilization. IPCC (2006) methodology was also used to estimate emissions from cultivation of organic soils. Use of a process-based model for inventories is known as a Tier 3 approach, while use of IPCC (2006) methodology is referred to as a Tier 1 approach. The methodology described below shows how the Tier 1 and Tier 3 approaches can be combined to derive overall emission estimates. Refer to EPA (2010, 2007) for a complete description of the methodologies used to estimate N₂O emissions.

3.3.2.1 DAYCENT Simulations for Major Crop Types

The DAYCENT ecosystem model (Del Grosso et al. 2001, Parton et al. 1998) was used to estimate direct N₂O emissions from mineral soils producing major crops, (corn, soybean, wheat, alfalfa hay, other hay, sorghum, and cotton) which represent approximately 86% of total cropland in the United States. DAYCENT simulated crop growth, soil organic matter decomposition, greenhouse gas fluxes, and key biogeochemical processes affecting N₂O emissions. The simulations were driven by model input data generated from daily weather records, land management, and soil physical properties determined in national soil surveys.

DAYCENT simulations were conducted for each major crop at the county scale in the U.S. The county scale was selected because soil, weather, and crop area data were available for every county. However, land management data (e.g., timing of planting, harvesting, and fertilizer application; intensity of cultivation; rate of fertilizer application) were only available at the agricultural region level as defined by the Agricultural Sector Model (McCarl et al. 1993). There are 63 agricultural regions in the contiguous United States; most states correspond to one region, except for those with greater heterogeneity in agricultural practices, which led to further subdivisions. Therefore, while several cropping systems were simulated for each county in an

agricultural region, the model parameters that determined the influence of management activities on soil N₂O emissions (e.g., when crops were planted/harvested, amount of fertilizer added), did not differ among those counties.

Corn, soybeans, wheat, alfalfa hay, other hay, sorghum, and cotton are defined as major crops and were simulated in every county where they were grown. For rotations that include a cycle that repeats every 2 or more years (e.g., corn/soybeans, wheat/corn/fallow) different simulations were performed where each phase of the rotation was simulated every year. For example, in regions where wheat/corn/fallow cropping is used, three rotations were simulated: one with wheat grown the first year, a second with corn the first year, and a third with fallow the first year. This ensured that each crop was represented during each year in one of the three simulations. In cases where the same crop was grown in the same year in two or more distinct rotations for a region, N₂O emissions were averaged across the different rotations to obtain a value for that crop. Emissions from cultivated fallow land were also included. Fallow area was assumed to be equal to winter wheat area in regions where winter wheat/fallow rotations are the dominant land management for winter wheat.

The simulations reported here assumed conventional tillage cultivation, gradual improvement of cultivars, and gradual increases in fertilizer application until 1989. We accounted for improvements of cultivars (cultivated varieties) because it is unrealistic to assume that modern corn is identical, in terms of yield potential, nitrogen demand, etc., as corn grown in 1900. Realistic simulations of historical land management and vegetation type are important because they influence present day soil carbon and nitrogen levels, which influence present day nitrogen cycling and associated N₂O emissions.

Nitrous oxide emission estimates from DAYCENT include the influence of N additions, crop type, irrigation, and other factors in aggregate, and therefore it is not possible to reliably partition N₂O emissions by anthropogenic activity (e.g., N₂O emissions from synthetic fertilizer applications cannot be distinguished from those resulting from manure applications). Consequently, emissions are not subdivided according to activity (e.g., N fertilization, manure amendments), as is suggested in the IPCC *Guidelines*, but the overall estimates are likely more accurate than the more simplistic IPCC method, which is not capable of addressing the broader set of driving variables influencing N₂O emissions. Thus, DAYCENT forms the basis for a more complete estimation of N₂O emissions than is possible with the IPCC methodology.

Uncertainty in the three major model inputs (weather, soil class, and N addition) was addressed using Monte Carlo analysis (Del Grosso et al. 2010). For example, although mean amounts of N fertilizer applied to different crops are known, the amounts of fertilizer applied by particular farmers are uncertain. Monte Carlo analysis provides a method to quantify how this type of uncertainty impacts N₂O emissions. There are three main steps in this analysis. First, a set of simulations was performed using mean N fertilizer additions, median weather, and the dominant soil texture class. These were designated the 0th simulations. Second, probability distribution functions were derived for N additions, weather, and soil texture class. Third, Monte Carlo simulations were performed for a subset of counties in each agricultural region.

In addition to uncertainty in model inputs, model structural error was also addressed. Model structural error stems from models not being perfect representations of reality. That is, models contain assumptions and imperfectly represent the processes that control crop growth and N₂O emissions. To quantify model structural error, N₂O emissions generated by DAYCENT were compared with emissions measured in field plots at various locations in North America.

3.3.2.2 0th Simulations

For each crop in each county, simulations were performed assuming the most common land management practice, the weather most representative of the land area in the county where each crop is grown, and the most common soil type for the land area where each crop is grown (0th simulations). Simulations included native vegetation (year one to plow out), historical agricultural practices (plow out to 1970) and modern agriculture (1971 through 2008). Plow out (the year when native soils were initially cropped) was assumed to occur between 1600 and 1850, depending on the state in which the county lies. Simulation of at least 1,600 years of native vegetation was needed to initialize soil organic matter (SOM) pools in the model. Modern weather was used to drive the simulations of native vegetation and historical cropping. Simulation of native vegetation and the historical cropping period was needed to establish modern day SOM levels, which is important because N₂O emissions are sensitive to the amount of SOM. Annual model outputs for N₂O emissions, NO₃ leached/runoff, and N volatilized were compiled for the years 1990-2008.

3.3.2.3 Probability Distribution Functions

Probability distribution functions (PDFs) were derived for key model inputs, including weather, soil type, and N amendments. In each county selected for the Monte Carlo analysis, all of the 1 km² cells with daily weather that correspond to the land area where row crops and small grains dominate were identified and assigned an equal probability of being selected in an individual Monte Carlo simulation. Cells with daily weather were similarly identified for the areas cropped with hay. The three dominant soil map units were identified for the land area with row crops and small grains, and each was assigned a probability given their relative level of dominance. Three soil map units were similarly identified and assigned probabilities for the areas where hay dominates.

Mineral N fertilization rates were based on two sets of PDFs, which were specified for individual crop types and hay. The first PDF was the probability of a fertilization event and the second PDF was a log-normal distribution of fertilization rates. Both PDFs were derived from USDA surveys and supplemental information (ERS 1997, USDA NASS 2009, 2004, 1999, Grant & Krenz 1985). Irrigated and rain-fed crops were treated separately due to significantly different fertilization rates. State-level PDFs were developed for crops and hay if a minimum of 15 survey data points existed in the state. Where data were insufficient at the state-level, PDFs were developed for multi-state Farm Production Regions.

Uncertainty in manure amendments for crops and hay was incorporated in the analysis based on total manure available for application in each county, a weighted average amendment rate, and the crop-specific land area amended with manure for 1997 (Edmonds et al. 2003). Edmonds et al.

(2003) provided county-level estimates of the proportion of specific crops and hay land amended with manure in 1997. EPA (2010) provided supplemental data on county-level variation in manure production across the time series from 1990 to 2008. We used the EPA data to scale the amended area in 1997 for each crop and hay under the assumption that more manure production would increase the area amended with manure, and vice versa. The estimated area was then divided by the respective total areas in the county for each crop and hay, yielding a probability of either including a manure amendment or not in the Monte Carlo analysis. If soils were amended with manure, a reduction factor was applied to the N fertilization rate accounting for the interaction between fertilization and manure N amendments (i.e., farmers usually reduce mineral fertilization rates if applying manure). Reduction factors were randomly selected from PDFs based on relationships between manure N application and fertilizer rates (ERS 1997).

3.3.2.4 Monte Carlo Simulations

In each agricultural region, two counties were randomly selected for Monte Carlo simulations. Additional counties were selected based on the variance in N₂O emissions across regions from previous simulations (Del Grosso et al. 2010) by using a Neyman allocation (Cochran 1977). Neyman's optimization apportions samples based on an estimated variance in soil N₂O emissions. Using this approach, greater variance leads to a higher sampling density within the respective region with the goal of optimally capturing variation across the croplands in the conterminous U.S. Regions with greater variance in N₂O emissions were assumed to have more variability in weather, soil characteristics, and agronomic practices, suggesting that more counties needed to be included in the Monte Carlo analysis. In total, 300 counties were selected for the Monte Carlo simulations. As with the 0th simulations, simulations of pre-settlement native vegetation and historical cropping patterns were performed in each county using the median weather for the county in combination with the three most dominant soil types.

One hundred Monte Carlo simulations were performed for each crop and hay type in the 300 counties selected for the Monte Carlo analysis. Random draws were made to select a soil type and weather file for the simulation from their respective PDFs, and the appropriate historical simulation was identified based on the soil type. Random draws were made to determine if mineral N fertilizer would be applied, the rate, and if the crop would be amended with manure. If manure was added, synthetic fertilizer rates were reduced based on an additional draw from the PDF for the reduction factors. The DAYCENT simulation was executed following the PDF draws and the process was repeated for a total of 100 iterations.

3.3.2.5 Nitrous Oxide Emission Estimates

Nitrous oxide emissions from the 0th simulation for each crop in each county in each agricultural region were adjusted by comparing the 0th simulation emissions to the mean emissions from the Monte Carlo simulations for that agricultural region. DAYCENT emissions for each crop in units of g N₂O-N m⁻² were multiplied by the county-level crop area based on NASS data. Lastly, emissions from all crops were summed to obtain county-level and national emissions from cropped soils.

3.3.2.6 Activity Data for DAYCENT Simulations

The activity data requirements for estimating N₂O emissions from major crop types include the following: daily weather, soil texture, native vegetation, crop rotation and land management information, N fertilizer rates and timing, manure amendment N rates and timing, and county-level crop areas. Unlike the IPCC approach, N inputs from crop residues are not considered activity data in the DAYCENT analysis because N availability from this source is internally generated by the model. That is, while the model accounts for the contribution of crop residues to the soil profile and subsequent N₂O emissions, this source of mineral soil N is not activity data in the sense that it is not a model input.

Daily Weather Data: Daily maximum/minimum temperature and precipitation were obtained from the DAYMET model, which generates daily surface precipitation, temperature, and other meteorological data at 1 km² resolution driven by weather station observations and an elevation model (Thornton et al. 2000, 1997, Thornton & Running, 1999). DAYMET weather data are available for the United States at 1 km² resolution for 1980 through 2003.

Soil Properties: Soil texture data required by DAYCENT were obtained from STATSGO (Soil Survey Staff, USDA Natural Resources Conservation Service, 2005) and were based on observations. Observed data for soil hydraulic properties needed for model inputs were not available, so they were calculated from STATSGO texture class and Saxton et al.'s (1986) hydraulic properties calculator.

Native Vegetation by County: Pre-agricultural land cover for each county was designated according to the potential native vegetation used in the VEMAP (1995) analysis, which was based on the Kuchler (1964) Potential Vegetation Map for the conterminous United States.

Crop Rotation and Land Management Information by Agricultural Region: Data for the 63 agricultural regions were obtained for specific timing and type of cultivation, timing of planting/harvest, and crop rotation schedules (Hurd 1930, 1929, Latta 1938, Iowa State College Staff Members 1946, Bogue 1963, Hurt 1994, USDA 2000a, USDA 2000c, CTIC 1998, Piper et al. 1924, Hardies & Hume 1927, Holmes 1902, 1929, Spillman 1902, 1905, 1907, 1908, Chilcott 1910, Smith 1911, Kezer ca. 1917, Hargreaves 1993, ERS 2002, Warren 1911, Langston et al. 1922, Russell et al. 1922, Elliot & Tapp 1928, Elliot 1933, Ellsworth 1929, Garey 1929, Hodges et al. 1930, Bonnen & Elliot 1931, Brenner et al. 2001, 2002, Smith et al. 2002).

Nitrogen Fertilizer Amendment Rates and Timing by Agricultural Region: Fertilizer application rates and timing of applications within each of the 63 agricultural regions were determined from regional, state, or sub-state estimates for different crops. Estimates were obtained primarily from the USDA Economic Research Service Cropping Practices Survey (ERS 1997) with additional data from other sources, including the National Agricultural Statistics Service (USDA NASS 2009, 2004, 1999). Prior to 1990, estimates for crop-specific regional fertilizer rates were based largely on extrapolation/interpolation of fertilizer rates from the years with available data. For crops in some agricultural regions, little or no data were available, and therefore a geographic regional mean was used to simulate N fertilization rates.

Managed Livestock Manure² Nitrogen Amendment Rates and Timing by Agricultural Region: Data on managed manure N amendments to soils were available for 1997 (Kellogg et al. 2000), and demonstrated that less than half of manure N produced on an annual basis was applied to soils. Crop-specific application rates of manure N for other years between 1990 and 2008 were obtained by multiplying the 1997 crop-specific rates by the ratio of managed manure N produced in that year to the managed manure N produced in 1997; the amount of land receiving manure (approximately 5 percent of total cropped land) was assumed to be constant during 1990 through 2008. Nitrogen available for application was estimated for managed systems based on the total amount of N produced in manure minus N losses and including the addition of N from bedding materials. Nitrogen losses include direct nitrous oxide emissions, volatilization of ammonia and NO_x, and runoff and leaching. The remaining manure N that was not applied to major crops and grassland was assumed to be applied to non-major crop types. Manure was applied during spring at the same time as synthetic N fertilizer. Prior to 1990, manure application rates and timing were based on various sources (Brooks 1901, Anonymous 1924, Fraps & Asbury 1931, Ross & Mehring 1938, Saltzer & Schollenberger 1938, Alexander & Smith 1990). As with mineral N fertilization, data for manure were incomplete, so regional averages were used to fill spatial gaps in data and interpolation/extrapolation was used to fill temporal gaps. Manure N application rates during 1990 through 2004 were based on Kellogg et al. (2000).

Crop Areas by Crop Type and by County: County-level total crop area data were downloaded from the USDA NASS Web site for the years 1990 through 2008 (USDA NASS 2009), and these data formed the basis to scale emissions from individual crop types across the entire county.

3.3.3 IPCC Methodology for Non-Major Crop Types

3.3.3.1 Mineral Soils

For mineral agricultural soils producing non-major crop types, the Tier 1 IPCC methodology was used to estimate direct N₂O emissions. Estimates of direct N₂O emissions from N applications to non-major crop types were based on the annual increase in mineral soil N from the following practices: (1) the application of synthetic commercial fertilizers, (2) the retention of crop residues, and (3) manure and non-manure organic fertilizers.

IPCC methodology for emissions from mineral soils is based on nitrogen inputs. Nitrogen inputs from synthetic and organic fertilizer and aboveground and belowground crop residues were added together. This sum was multiplied by the IPCC default emission factor (1.0%) to derive an estimate of cropland direct N₂O emissions from non-major crop types. Nitrate leached or runoff and N volatilized from non-major crop types are calculated by multiplying N fertilizer applied by the IPCC (2006) default factors (30% and 10%, respectively).

² For purposes of the Inventory, total livestock manure is divided into two general categories: (1) managed manure, and (2) unmanaged manure. Managed manure includes manure that is stored in manure management systems such as pits and lagoons, as well as manure applied to soils through daily spread operations. Unmanaged manure encompasses all manure deposited on soils by animals on pasture, range, and paddock.

Annual synthetic fertilizer nitrogen additions to non-major crop types are calculated by process of elimination. For each year, fertilizer applied to major crops and grazed lands (as simulated by DAYCENT – approximately 80% of the U.S. total fertilizer used on farms) was subtracted from total fertilizer used on farms in the United States. The difference, approximately 20% of total synthetic fertilizer N used on farms in the U.S., was assumed to be applied to non-major crop types. Non-major crop types include fruits, nuts, and vegetables, which is estimated at approximately 5% of total U.S. N fertilizer use (TFI 2000), and other annual crops not simulated by DAYCENT, barley, oats, tobacco, sugarcane, sugar beets, sunflower, millet, peanuts, etc., which account for approximately 15% of total U.S. fertilizer used on farms. Manure N applied to non-major crops was estimated in a similar manner; manure applied to major crops and grazed lands as simulated by DAYCENT was subtracted from total manure available for soil application. This difference was assumed to be applied to non-major crops. In addition to synthetic fertilizer and manure N, nitrogen in soils due to the cultivation of non-major N-fixing crops (e.g., edible legumes) was included in these estimates. Finally, crop residue nitrogen was derived from information on crop production yields, residue management (retained vs. burned or removed), mass ratios of aboveground residue to crop product, dry matter fractions, and nitrogen contents of the residues (IPCC 2006). The activity data for these practices were obtained from the following sources:

- Annual production statistics for crops whose residues are left on the field: USDA (2003, 2002, 2001, 2000a, 1998, 1994), Schueneman (2001, 1999a, 1999b, 1999c), Deren (2002), Schueneman and Deren (2002), Cantens (2004), Lee (2004, 2003).
- Crop residue N was derived by combining amounts of above- and below-ground biomass, which were determined based on crop production yield statistics (USDA 2006, 2005, 2003, 1998, 1994), dry matter fractions (IPCC 2006), linear equations to estimate above-ground biomass given dry matter crop yields (IPCC 2006), ratios of below-to-above-ground biomass (IPCC 2006), and N contents of the residues (IPCC 2006).

Annual Applications of Commercial Non-Manure Organic Fertilizers by Agricultural Region: Estimates of total national annual N additions from land application of other organic fertilizers were derived from organic fertilizer statistics (TVA 1994, 1993, 1992a, AAPFCO 2006, 2005, 2004, 2003, 2002, 2000a, 2000b, 1999, 1998, 1997, 1996, 1995). The organic fertilizer data, which are recorded in mass units of fertilizer, had to be converted to mass units of N by multiplying by the average organic fertilizer N contents provided in the annual fertilizer publications. These N contents are weighted average values, and vary from year to year (ranging from 2.3 percent to 3.9 percent over the period 1990 through 2004). Annual on-farm use of these organic fertilizers is very small, less than 0.03 Tg N.

3.3.3.2 Cultivation of Histosols

The IPCC Tier 1 method is used to estimate direct N₂O emissions from the drainage and cultivation of organic cropland soils. Estimates of the total U.S. acreage of drained organic soils cultivated annually for temperate and sub-tropical climate regions was obtained for 1982, 1992, and 1997 from the Natural Resources Inventory (USDA 2000b, as extracted by Eve 2001 and amended by Ogle 2002), using temperature and precipitation data from Daly et al. (1998, 1994). To estimate annual N₂O emissions from histosol cultivation, the temperate histosol area is multiplied by the IPCC default emission factor for temperate soils (8 kg N₂O-N/ha cultivated;

IPCC 2006), and the sub-tropical histosol area is multiplied by the average of the temperate and tropical IPCC default emission factors (12 kg N₂O-N/ha cultivated; IPCC 2006).

3.3.3.3 Total N₂O Emissions

Total direct emissions were obtained by summing DAYCENT-generated emissions from major crops on mineral soils, IPCC-generated estimates for non-major crops on mineral soils, and IPCC estimates of emissions from organic soils. Total indirect emissions from NO₃ leaching or runoff were obtained by adding DAYCENT estimates for major crops on mineral soils to IPCC (2006) estimates for non-major crops on mineral soils and multiplying by the default emission factor (0.75% of N leached/runoff). Total indirect emissions from nitrogen volatilization were obtained by adding DAYCENT estimates for major crops on mineral soils to IPCC (2006) estimates for non-major crops on mineral soils and multiplying by the default emission factor (1% of N volatilized). Indirect emissions from NO₃ leaching or runoff were added to those from nitrogen volatilization to get total indirect emissions. Total direct and indirect emissions were then summed to get total N₂O emissions from cropped soils.

3.3.4 Uncertainty in N₂O Emissions

Uncertainty was estimated differently for each of the following components of N₂O emissions from cropped soils: direct emissions from major crops calculated by DAYCENT due to model input uncertainty, direct emissions from major crops calculated by DAYCENT due to model structure uncertainty, direct emissions from minor crops not calculated by DAYCENT, and indirect emissions from all crops. For direct emissions calculated using DAYCENT, model input uncertainty was quantified using the Monte Carlo analysis described above in section 3.3.2 and in more detail by Del Grosso et al. (2010). Model structure uncertainty was quantified by comparing DAYCENT estimates of N₂O emissions with measured values (Del Grosso et al. 2010). Uncertainty for direct emissions from minor crops was estimated using simple error propagation (IPCC 2006). Uncertainty in indirect emissions for major crops combined uncertainty in DAYCENT estimates of nitrate leaching and N gas volatilization based in the Monte Carlo simulations with uncertainty in the IPCC Tier 1 emissions factors used to convert these N loss vectors to N₂O emissions. Uncertainty in indirect emissions for minor crops combined uncertainty in IPCC Tier 1 emissions factors for nitrate leaching and N gas volatilization with uncertainty in the IPCC Tier 1 emissions factors used to convert these N loss vectors to N₂O emissions. Error propagation was used to combine uncertainties in the various components by taking the square root of the sum of the squares of the standard deviations of the components (IPCC 2006). The 95% confidence interval in N₂O emissions was estimated to lie between 114 and 241 Tg CO₂ eq. (Table 3-1).

3.3.5 Changes Compared to the 2nd Edition of the USDA GHG Report

Although there were no major changes in methodologies compared to the previous edition (USDA 2008), a series of improvements were implemented. Instead of assuming that nitrate leaching can occur anywhere, a criterion was used to designate lands where nitrate is susceptible to be leached into waterways, as suggested by IPCC (2006). This is based on observations that in semi-arid and arid areas, nitrate can be leached below the rooting zone, but it does not enter waterways because water tables in dry areas are low or non-existent. Other changes include:

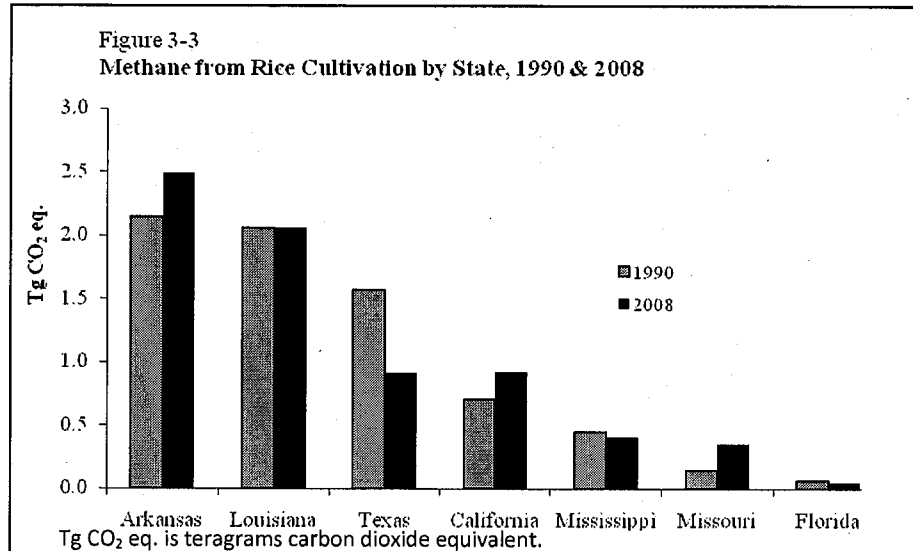
using state-level N data for on-farm use of fertilizers to estimate synthetic N fertilizer application on non-major crops, including uncertainty in DAYCENT outputs of N volatilization and N leaching/runoff in the calculation of uncertainty for indirect emissions; using a default uncertainty of ± 50 percent for Tier 1 uncertainties that were not addressed in the previous inventory (e.g., crop yields and organic fertilizer amendments); assuming that manure N available for land application not accounted for by the DAYCENT simulations was applied to non-major crop types; revising DAYCENT parameterization for sorghum; correcting an error in the empirically based uncertainty estimator; improved estimates of manure additions to croplands; and using sugar-cane-specific information for calculating the residue/crop ratio, fraction of residue burned, dry matter fraction, burning efficiency, and combustion efficiency for this crop. The main results of these changes are lower N_2O emissions and wider confidence intervals. Lower N_2O emission estimates were primarily due to the new operational version of DAYCENT and the revised structural uncertainty associated with the model. Earlier versions of DAYCENT tended to overestimate emissions, and although these emissions were adjusted using the structural uncertainty estimator, there was considerable uncertainty in those adjustments and it is likely that high estimates were not sufficiently adjusted downwards. The new operational version of DAYCENT does not systematically overestimate N_2O emissions for the majority of crops so overall emissions are lower. Including residual error from the linear mixed-effect model as a component of the structural uncertainty and accounting for additional sources of uncertainty mentioned above that were previously neglected are responsible for the wider uncertainty intervals.

3.3.6 Mitigation of N_2O Emissions

Mitigation of N_2O emissions is based on optimizing the amount and timing of nitrogen fertilizer additions. Excess fertilizer applied to crops increases the nitrogen available for N_2O , N oxide and NH_3 emissions, and for NO_3 leaching. Using time-released fertilizers and applying fertilizer in multiple applications improves the synchrony between nitrogen supply and plant nitrogen demand. However, multiple applications of fertilizer require increased time and equipment usage by farmers and time-released fertilizers are more expensive than conventional fertilizers. Use of nitrification inhibitors has been shown to decrease N_2O emissions (Halvorson et al. 2010a, 2010b, Weiske et al. 2001, McTaggart et al. 1997). The capability to simulate their impact has been incorporated into the DAYCENT ecosystem model. National-scale DAYCENT simulations suggest that universal use of nitrification inhibitors could reduce total N_2O emissions by 10-20% while maintaining, or slightly increasing, crop yields. The model showed lower direct N_2O and NO_x emissions because nitrification rates were decreased, but also lower NO_3 leaching rates because reduced nitrification also reduces inputs to the soil NO_3 pool. However, fertilizer amended with nitrification inhibitors, as with time-released fertilizer, is more expensive. Further analyses of the environmental and economic costs and benefits of improved N source fertilizers need to be performed before optimum region-specific mitigation strategies can be identified.

3.4 Methane Emissions from Rice Cultivation

Methane emissions from rice cultivation³ are limited to seven U.S. states (Figure 3-3). In four states (Arkansas, Florida, Louisiana, and Texas), the climate allows for cultivation of two rice crops per season, the second of which is referred to as a ratoon crop (EPA 2010). Methane emissions from primary and ratoon crops are accounted for separately because emissions from ratoon crops are higher (EPA 2010). Overall, rice cultivation is a small source of CH₄ in the United States. In 2008,



CH₄ emissions totaled 7.2 Tg CO₂ eq, of which 5.3 Tg CO₂ eq. were from primary crops in all seven states and 1.9 Tg CO₂ was from ratoon crops in four states (Table 3-4).

Table 3-4 Methane from Rice Cultivation from Primary and Ratoon Operations by State, 1990, 1995, 2000-2008

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Source	Tg CO ₂ eq.										
Primary	5.1	5.6	5.5	5.9	5.7	5.4	6.0	6.0	5.1	4.9	5.3
Arkansas	2.1	2.4	2.5	2.9	2.7	2.6	2.8	2.9	2.5	2.4	2.5
California	0.7	0.8	1.0	0.8	0.9	0.9	1.1	0.9	0.9	1.0	0.9
Florida	0.02	0.04	0.03	0.02	0.02	0.01	0.02	0.02	0.02	0.03	0.02
Louisiana	1.0	1.0	0.9	1.0	1.0	0.8	1.0	0.9	0.6	0.7	0.8
Mississippi	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.5	0.3	0.3	0.4
Missouri	0.1	0.2	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.4
Texas	0.6	0.6	0.4	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3
Ratoon	2.1	2.1	2.0	1.7	1.1	1.5	1.6	0.8	0.9	1.3	1.9
Arkansas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Florida	0.04	0.08	0.05	0.05	0.04	0.04	0.05	0.00	0.02	0.03	0.03
Louisiana	1.1	1.1	1.3	1.1	0.5	1.0	1.1	0.5	0.5	0.9	1.2
Texas	0.9	0.8	0.7	0.6	0.5	0.5	0.5	0.4	0.4	0.3	0.6
Total	7.1	7.6	7.5	7.6	6.8	6.9	7.6	6.8	5.9	6.2	7.2

Note: Tg CO₂ eq. is teragrams carbon dioxide equivalent.

³ This source focuses on CH₄ emissions resulting from anaerobic decomposition and does not include emissions from burning of rice residues. The latter is covered in section 3.5.

Arkansas and Louisiana had the highest CH₄ emissions (2.91 Tg CO₂ eq. and 1.4 Tg CO₂ eq. respectively) from rice cultivation in 2008, followed by California and Texas. Mississippi, Missouri, and Florida each had emissions less than or equal to 0.5 Tg CO₂ eq. (Table 3-4). Overall since 1990, CH₄ emissions from rice cultivation have increased by 1% (Table 3-5). While national-scale changes were small between 1990 and 2008 (1% increase), sizeable shifts occurred at state levels during that time period. For example, CH₄ emissions in Missouri and California increased by 149% and 31%, respectively, while emissions in Texas declined by 42% (Table 3-5). Although CH₄ emissions from Missouri increased by 149% between 1990 and 2008, they remained small in magnitude relative to emissions from other states because of the small land area used for rice production in this state. State-level shifts in CH₄ emissions since 1990 are positively correlated with changes in area of rice cultivation (Appendix Table B-1). Appendix Table B-1 provides a complete time series of areas harvested for rice by state with primary versus ratoon crops from 1990-2008.

3.4.1 Methods for Estimating CH₄ Emissions from Rice Cultivation

The EPA provided estimates for CH₄ emissions from rice cultivation for this report. Details on the methods are provided below and are excerpted, with permission from EPA, from Chapter 6 of the U.S. GHG Inventory report (EPA 2010). The method used by EPA applies area-based seasonally integrated emission factors (i.e., amount of CH₄ emitted over a growing season per unit harvested area) to harvested rice areas to estimate annual CH₄ emissions from rice cultivation. The EPA derives specific CH₄ emission factors from published studies containing rice field measurements in the United States, with separate emissions factors for ratoon and primary crops to account for higher seasonal emissions in ratoon crops.

A review of published experiments was used to develop emissions factors for primary and ratoon crops. Experiments where nitrate or sulfate fertilizers or other substances believed to suppress CH₄ formation were applied, and experiments where measurements were not made over an entire flooding season or where floodwaters were drained mid-season, were excluded from the analysis. The remaining experimental results were then sorted by season (i.e., primary and ratoon) and type of fertilizer amendment (i.e., no fertilizer added, organic fertilizer added, and synthetic and organic fertilizer added). The experimental results from primary crops with synthetic and organic fertilizer added (Bossio et al. 1999, Cicerone et al. 1992, Sass et al. 1991a and 1991b) were averaged to derive an emission factor for the primary crop, and the experimental results from ratoon crops with synthetic fertilizer added (Lindau et al. 1995, Lindau & Bollich 1993) were averaged to derive an emission factor for the ratoon crop. The resultant emission factor for the primary crop is 210 kg CH₄/ha per season, and the resultant emission factor for the ratoon crop is 780 kg CH₄/ha per season.

Table 3-5 Change in Methane Emissions from Rice Cultivation, 1990-2008

	1990	2008	1990-2008
State	Tg CO ₂ eq.		% Change
Arkansas	2.14	2.49	16%
California	0.70	0.92	31%
Florida	0.06	0.05	-19%
Louisiana	2.06	2.06	0%
Mississippi	0.45	0.41	-8%
Missouri	0.14	0.36	149%
Texas	1.57	0.91	-42%
Total	7.12	7.20	1%

Note: Tg CO₂ eq. is teragrams carbon dioxide equivalent.

The harvested rice areas for the primary and ratoon crops in each state are presented in Appendix Table B-1. Primary crop areas for 1990 through 2008 for all states except Florida and Oklahoma were taken from USDA NASS Field Crops Final Estimates 1987-1992 (USDA 1994), Field Crops Final Estimates 1992-1997 (USDA 1998a), Crop Production 2000 Summary (USDA 2003), and Crop Production 2001 Summary (USDA 2005-2009). Harvested rice areas in Florida, which are not reported by USDA, were obtained from Tom Schueneman (2001, 2000, 1999b, 1999c), a Florida agricultural extension agent, and Chris Deren (2002) of the Everglades Research and Education Center at the University of Florida. Acreages for the ratoon crops were derived from conversations with the agricultural extension agents in each state. California, Mississippi, Missouri, and Oklahoma have not ratooned rice over the period 1990 through 2008 (Guethle 1999, 2000, 2001, 2002 through 2008; Lee 2003 through 2007; Mutters 2002 through 2005; Street 1999 through 2003; Walker 2005, 2007, 2008). In Arkansas, ratooning occurred only in 1998 and 1999, when the ratoon area was less than 1% of the primary area (Slaton 2001, 2000, 1999). In Florida, the ratoon area was 50% of the primary area from 1990 to 1998 (Schueneman 1999a), about 65% of the primary area in 1999 (Schueneman 2000), around 41% of the primary area in 2000 (Schueneman 2001), and about 70% of the primary area in 2001 (Deren 2002). In Louisiana, the percentage of the primary area in ratoon was constant at 30% over the 1990 to 1999 period, but increased to approximately 40% in 2000 before returning to 30% in 2001 (Linscombe 2002, 2001, 1999a, Bollich 2000). In Texas, the percentage of the primary area in ratoon was constant at 40% over the entire 1990 to 1999 period and in 2001, but increased to 50% in 2000 due to an early primary crop (Klosterboer 2002, 2001, 2000, 1999a, 1999b).

3.4.2 Uncertainty in Estimating Methane Emissions from Rice Cultivation

The following discussion of uncertainty in estimating GHG emissions from rice cultivation is modified from information provided in the U.S. GHG Inventory (EPA 2010). The information is reproduced here with permissions from the EPA.

Methane emission factors are the largest source of uncertainty in estimates for rice cultivation. Seasonal emissions, derived from field measurements in the United States, vary by more than an order of magnitude resulting from a variation in cultivation practices, fertilizer applications, cultivar types, soil, and climatic conditions. Some variability is accounted for by separating primary from ratoon areas. However, even within a cropping season, measured emissions vary significantly. Of the experiments that were used to derive the emission factors used here, primary emissions ranged from 22 to 479 kg CH₄/ha per season and ratoon emissions ranged from 481 to 1,490 kg CH₄/ha per season.

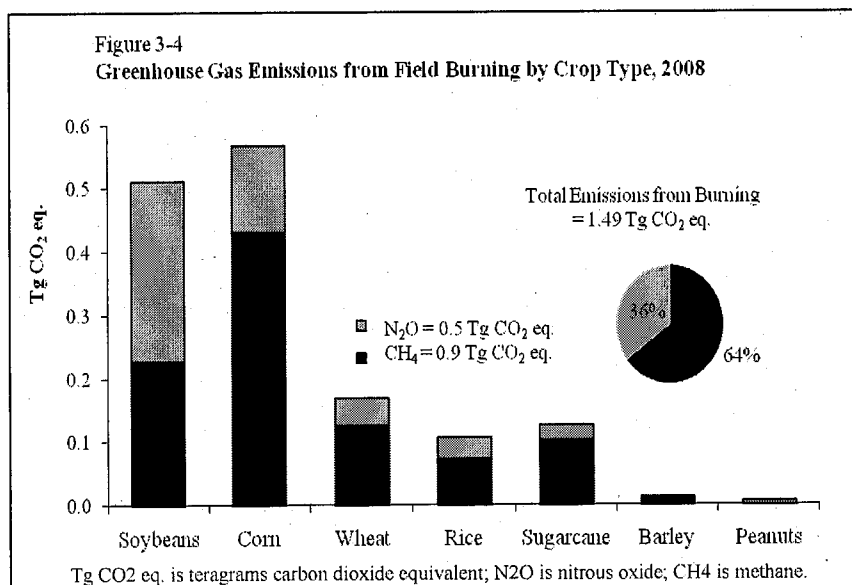
Data are not collected regularly on the area of rice crops in ratoon, creating another source of uncertainty. The area estimates are derived from expert opinion and account for 1 to 5% of the total area of rice cultivation. A final source of uncertainty is the practice of flooding outside of the normal rice season. According to agriculture extension agents, this occurs in all rice-growing states. No uncertainties were calculated for the practice of flooding outside of the normal rice season because CH₄ flux measurements have not been undertaken over a sufficient geographic range or under a broad enough range of representative conditions to account for this source in the emission estimates or its associated uncertainty.

To quantify the uncertainties for emissions from rice cultivation, a Monte Carlo (Tier 2) uncertainty analysis was performed using the information provided above. The results of the Tier 2 quantitative uncertainty analysis are summarized in Table 3-1. Rice cultivation CH₄ emissions in 2008 were estimated to be between 2.6 and 17.5 Tg CO₂ eq. at a 95-percent confidence level, which indicates a range of 64 percent below to 143 percent above the actual 2008 emission estimate of 7.2 Tg CO₂ eq.

3.5 Residue Burning

Greenhouse gas emissions from field burning of crop residues are a function of the amount and type of residues burned. In the U.S., crops burned include wheat, rice, sugarcane, corn, barley, soybeans, and peanuts (EPA 2010). For most crops, less than 5% of residues are burned per year, but a higher portion of rice residues is burned annually (EPA 2010). Consequently, emissions from residue burning are a small source of overall crop-related emissions in the U.S. About three-fifths of GHG emissions from residue burning, across all crop types, consisted of CH₄ in 2008; the remaining was N₂O (Table 3-6, Figure 3-4). CO₂ burning is not considered a GHG

source because the CO₂ lost from burning was assimilated during the year by growing vegetation. The highest GHG emissions were from burning of corn and soybean crop residues, at 38 and 34% respectively. Burning of wheat, rice, sugarcane, and barely crop residues each contributed 11% or less to overall GHG emissions;



burning of peanut crop residues contributed almost nothing to this source of GHG due to the relatively small amount of land area planted with this crop.

Total greenhouse gas emissions from residue burning increased 29% from 1990 to 2008. Trends in relative GHG emissions were similar across crop types in 1990 compared to 2008 with a few exceptions. In both 1990 and 2008, burning of corn residues contributed the most to GHG emissions from residue burning, while burning of soybeans was the second largest source. Between 1990 and 2008, soybean and corn production both increased in absolute amounts (Figure 3-5). However, proportionally, soybean production increased slightly more than corn (soybean production increased by 54% and corn by 53%) (Figure 3-6). Despite the higher nitrogen content in soybeans relative to corn, corn production was still greater than soybean

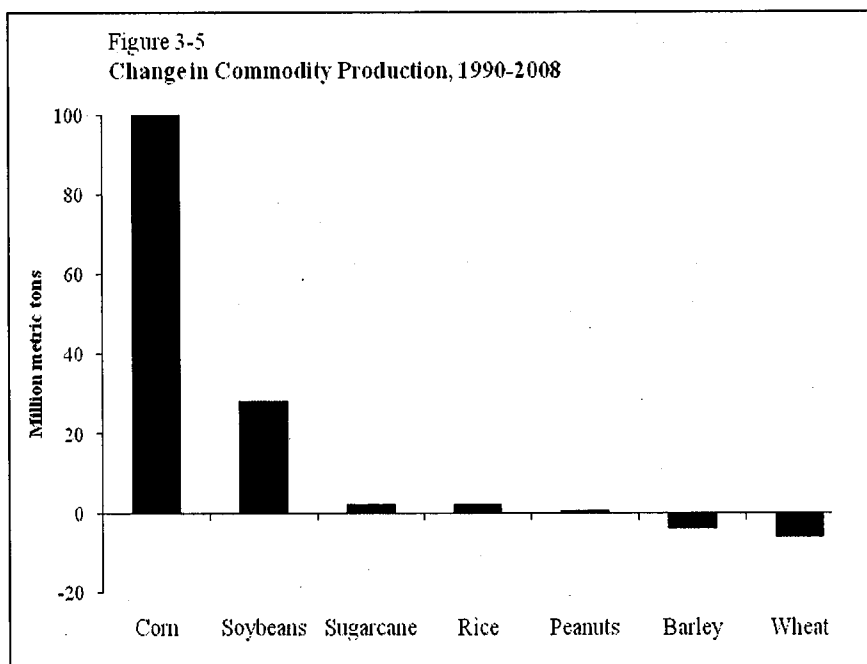
production in 2008, thus resulting in higher GHG emissions from residue burning.

Table 3-6 Greenhouse Gas Emissions from Agriculture Burning by Crop, 1990, 1995, 2000-2008

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Source	<i>Tg CO₂ eq.</i>										
CH₄	0.77	0.75	0.89	0.87	0.80	0.89	0.96	0.93	0.90	0.96	0.97
Wheat	0.14	0.11	0.11	0.10	0.08	0.12	0.11	0.11	0.09	0.10	0.13
Rice	0.09	0.09	0.08	0.08	0.06	0.10	0.08	0.09	0.09	0.08	0.07
Sugarcane	0.09	0.10	0.12	0.11	0.12	0.11	0.10	0.09	0.10	0.10	0.10
Corn	0.28	0.26	0.35	0.34	0.32	0.36	0.42	0.40	0.37	0.46	0.43
Barley	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Soybeans	0.15	0.17	0.21	0.22	0.21	0.19	0.24	0.24	0.25	0.21	0.23
Peanuts	0.002	0.002	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.002	0.003
N₂O	0.39	0.40	0.48	0.49	0.45	0.47	0.53	0.52	0.52	0.50	0.52
Wheat	0.05	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.04
Rice	0.04	0.04	0.04	0.04	0.03	0.05	0.04	0.04	0.04	0.04	0.03
Sugarcane	0.021	0.023	0.028	0.026	0.027	0.026	0.022	0.020	0.023	0.023	0.023
Corn	0.09	0.08	0.11	0.11	0.10	0.11	0.13	0.12	0.12	0.15	0.14
Barley	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soybeans	0.18	0.21	0.26	0.28	0.26	0.23	0.30	0.29	0.31	0.26	0.28
Peanuts	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.002
Total	1.16	1.14	1.37	1.35	1.26	1.36	1.49	1.45	1.43	1.46	1.49

Note: Tg CO₂ eq. is teragrams carbon dioxide equivalent; CH₄ is methane; N₂O is nitrous oxide.

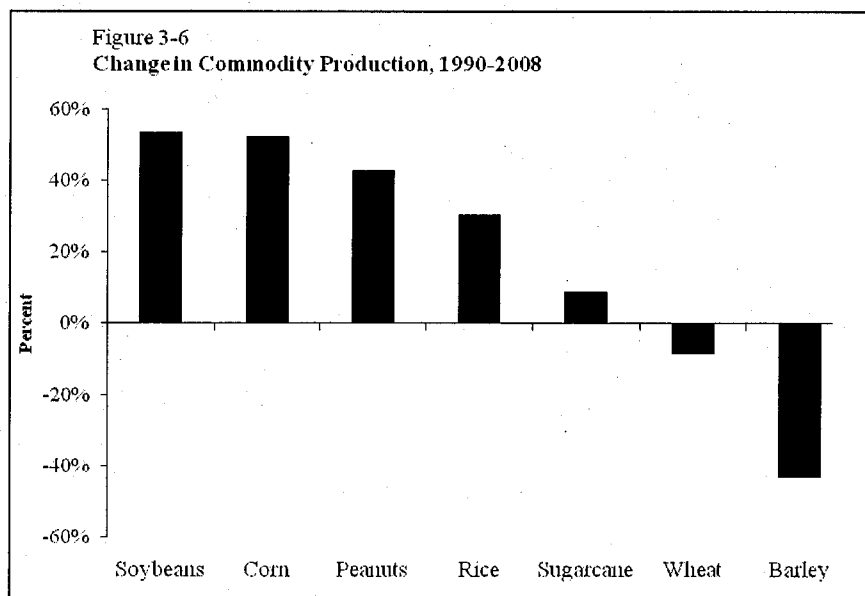
Appendix Table B-2 provides the complete time series of crop production from 1990 to 2008 for crop types that contribute to GHG emissions from burning. Appendix Table B-3 provides nationwide data for crop production managed with burning by year. Production of crops such as corn and soybeans has been slowly increasing since 1990, with other crops like wheat, rice, and sugarcane remaining relatively constant or decreasing. Barley production has declined since the mid-1990s.



The state-level rice harvest estimates were provided directly by EPA based on state production data.

3.5.1 Methods for Estimating CH₄ and N₂O Emissions from Residue Burning

EPA provided national-level estimates of GHG emissions from agricultural residue burning for all crop types, and state-level estimates for GHG emissions from rice residue burning for this report. In addition, state-level estimates were derived by USDA for all crop types (except rice) using the same method. Details on the methods used by EPA are provided below, including



excerpts from Chapter 6 of the U.S. GHG Inventory report (EPA 2010). This information is reproduced with permission from EPA.

The equations below were used to estimate the amounts of carbon and nitrogen released during burning.

$$\begin{aligned} \text{Carbon Released} = & (\text{Annual Crop Production}) \times (\text{Residue/Crop Product Ratio}) \\ & \times (\text{Fraction of Residues Burned in situ}) \times (\text{Dry Matter Content of the Residue}) \\ & \times (\text{Burning Efficiency}) \times (\text{Carbon Content of the Residue}) \times (\text{Combustion Efficiency}) \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Released} = & (\text{Annual Crop Production}) \times (\text{Residue/Crop Product Ratio}) \\ & \times (\text{Fraction of Residues Burned in situ}) \times (\text{Dry Matter Content of the Residue}) \\ & \times (\text{Burning Efficiency}) \times (\text{Nitrogen Content of the Residue}) \times (\text{Combustion Efficiency}) \end{aligned}$$

Values used in the above equations to estimate emissions from residue burning are summarized in Appendix Table B-4. National and state-level crop production statistics are provided in Appendix Table B-2 and Appendix Table B-3. The sources for developing these input data are described for each parameter below.

Annual Crop Production:

Crop production data for all crops except rice in Florida and Oklahoma were taken from the USDA's Field Crops, Final Estimates 1987–1992, 1992–1997, 1997–2002 (USDA 1994, 1998, 2003), and *Crop Production Summary* (USDA 2005 through 2009). Rice production data for Florida and Oklahoma, which are not collected by USDA, were estimated separately. Average primary and ratoon crop yields for Florida (Schueneman & Deren 2002) were applied to Florida

acreages (Schueneman 1999b, 2001; Deren 2002; Kirstein 2003, 2004; Cantens 2004, 2005; Gonzalez 2007a, 2008, 2009), and crop yields for Arkansas (USDA 1994, 1998, 2003, 2005 through 2009) were applied to Oklahoma acreages (Lee 2003 through 2006; Anderson 2008, 2009).

Residue-to-Crop Product Mass Ratios:

All residue/crop product mass ratios except sugarcane were obtained from Strehler and Stützel (1987). The ratio for sugarcane is from Kinoshita (1988).

Fraction of Residues Burned:

The percentage of crop residue burned was assumed to be 3 percent for all crops in all years, except rice and sugarcane, based on state inventory data (Noller 1996, Cibrowski 1996, Oregon Department of Energy 1995, ILENR 1993, and the Wisconsin Department of Natural Resources 1993). Estimates of the percentage of rice residue burned were derived from state-level estimates of the percentage of rice area burned each year, which were multiplied by state-level annual rice production statistics. The annual percentages of rice area burned in each state were obtained from agricultural extension agents in each state and reports of the California Air Resources Board (Buehring 2009; Guethle 2009, 2008, 2007; Lancero 2006 through 2009; Texas Agricultural Experiment Station 2006 through 2009; Wilson 2003, 2004, 2005, 2007, and 2009; Lee 2005 through 2007; Sacramento Valley Basinwide Air Pollution Control Council 2005 and 2007; Walker 2004 through 2008; anonymous 2006; Cantens 2005; Stansel 2004, 2005; Lindberg 2002, 2003; Deren 2002; Najita 2001 and 2000; California Air Resources Board 2001, 1999; Bollich 2000; Fife 1999; Street 2001 through 2003; Klosterboer 2000 through 2003, 1999a, 1999b; Linscombe 2001 through 2009, 1999a, 1999b; Schueneman 2001, 1999a, 1999b). The estimates provided for Florida remained constant over the entire 1990 through 2008 period. While the estimates for all other states varied over the time series, estimates for Missouri remained constant through 2005, dropped in 2006, and remained constant near the 2006 value in 2007 and 2008. For California, the annual percentages of rice area burned in the Sacramento Valley are assumed to be representative of burning in the entire state, because the Sacramento Valley accounts for over 95 percent of the rice acreage in California (Fife 1999). These values generally declined between 1990 and 2008 because of a legislated reduction in rice straw burning (Lindberg 2002), although there was a slight increase from 2004 to 2005 and from 2006 to 2007. Estimates for percent of sugarcane burned were obtained from Ashman (2008).

Residue Dry-Matter Content:

Residue dry-matter contents for all crops except soybeans and peanuts were obtained from Turn et al. (1997). Soybean dry-matter content was obtained from Strehler and Stützel (1987). Peanut dry-matter content was obtained through personal communications with Jen Ketzis (1999), who accessed Cornell University's Department of Animal Science's computer model, Cornell Net Carbohydrate and Protein System.

Burning and Combustion Efficiency:

Burning efficiency refers to the fraction of dry biomass exposed to burning that actually burns and the combustion efficiency refers to the fraction of carbon in the fire that is oxidized completely to CO₂. The burning efficiency was assumed to be 93% and the combustion efficiency was assumed to be 88%, for all crop types, except sugarcane (EPA 1994). For

sugarcane, the burning efficiency was assumed to be 81% (Kinoshita 1988) and the combustion efficiency was assumed to be 68% (Turn et al. 1997). Emission ratios and conversion factors for all gases were taken from IPCC Guidelines (1996).

Carbon and Nitrogen Content:

The residue carbon contents and nitrogen contents for all crops except soybeans and peanuts are from Turn et al. (1997). The residue carbon content for soybeans and peanuts is the IPCC default (IPCC UNEP OECD IEA 1997). The nitrogen content of soybeans is from Barnard and Kristoferson (1985) and the nitrogen content of peanuts is from Ketzis (1999).

3.5.2 Uncertainty in Estimating Methane and Nitrous Oxide Emissions from Residue Burning

The following discussion of uncertainty in estimating GHG emissions from residue burning is modified from information provided in the U.S. GHG Inventory (EPA 2010). The information is reproduced here with permission from EPA.

Assumptions about the annual amount of residues burned by crop type are the largest source of uncertainty in estimating GHG emissions from field burning of agricultural residues. Data on the fraction burned, as well as the gross amount of residue burned each year, is not collected at either the national or state level. In addition, burning practices are highly variable among crops and states. The fractions of residue burned used in these calculations are based upon information collected by state agencies and in published literature. These emissions estimates may continue to change as more information becomes available in the future. Other sources of uncertainty include the residue/crop product mass ratios, residue dry matter contents, burning and combustion efficiencies, and emission ratios. Residue/crop product ratios for specific crops can vary among cultivars and, for all crops except sugarcane, generic global residue/crop product ratios were used rather than ratios specific to the United States. In addition, residue dry matter contents, burning and combustion efficiencies, and emission ratios can vary due to weather and other combustion conditions, such as fuel geometry. Values for these variables were taken from literature on agricultural biomass burning.

A Monte Carlo analysis was performed to quantify the uncertainties mentioned above. The calculated 95% confidence interval was 0.2 to 1.0 Tg CO₂ eq. for N₂O emissions from residue burning, or 71% below and 83% above the estimate of 0.5 Tg CO₂ eq. and 0.3 to 1.8 Tg CO₂ eq. for CH₄ emissions from residue burning, or 68% below and 88% above the estimate of 1.0 Tg CO₂ eq. (Table 3-1).

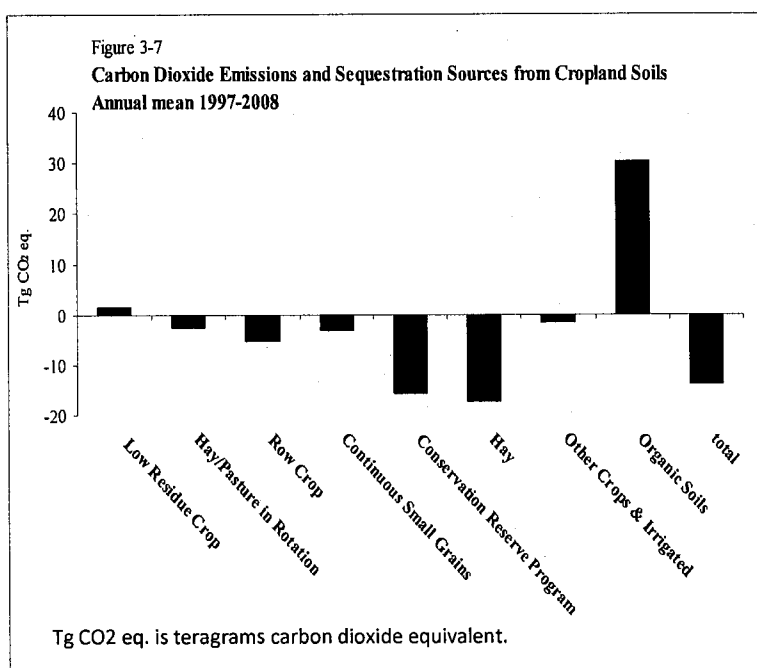
3.6 Carbon Stock Changes in Cropped Soils

Except for cultivated organic soils and liming practices, cropped soils in the U.S. were estimated to accumulate about 42 Tg CO₂ eq. in 2008 (Table 3-1)⁴. Much of the carbon change is

⁴ Emissions and sinks of carbon in agricultural soils are expressed in terms of CO₂ equivalents; carbon sequestration is a result of changes in stocks of carbon in soils, from which CO₂ fluxes are inferred. Units of CO₂ equivalent can be converted to carbon using a multiplier of 0.272.

attributable to the Conservation Reserve Program, land use conversions between annual croplands and perennial hay and grazing lands, and land management (Figure 3-7). Practices such as the adoption of conservation tillage, including no-till, which have taken place over the past two decades, and reduced frequency of summer-fallow are important drivers of carbon stock changes. Manure applications to cropland also impact the estimated soil carbon stock increase.

In contrast, the small area of cultivated organic soils – less than 1 million hectares of a total 386 million hectares of agricultural and forest land – concentrated in Florida, California, the Gulf and Southeastern coastal region, and parts of the upper Midwest was a net source of CO₂ emissions for all years covered by the inventory (1990-2008). In 2008, about 30 Tg CO₂ eq. was emitted from cultivation of these soils (Table 3-1). Liming of agricultural soils resulted in emissions of about 4 Tg CO₂ eq per year. Total net carbon sequestration in 2008 equaled ~8 Tg CO₂ eq. when all of the above components were taken into consideration. Carbon uptake on agricultural soils varied between 1990 and 2008 (Table 3-2), driven largely by land use changes and weather fluctuations.



Most states in the Corn Belt and northern Great Plains are storing C in cropped soils due to adoption of reduced tillage and other practices (Map 3-3). The exception to this is Minnesota, which is losing C at the state level. Carbon losses from cropping of organic soils exceed C gains in mineral soil cropping for this state. Florida has the highest C losses, primarily due to sugarcane cropping on organic soils.

3.6.1 Methods for Estimating Carbon Stock Changes in Agricultural Soils

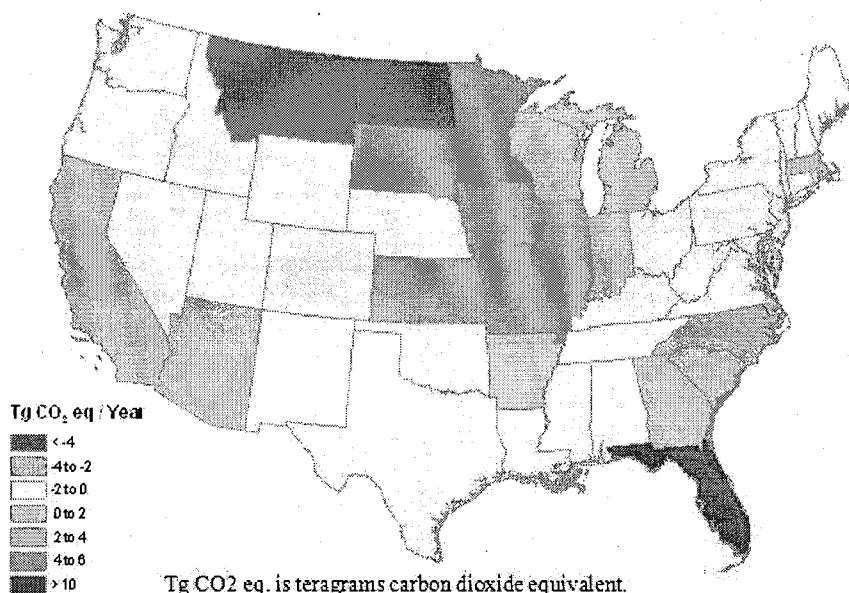
Two broad categories of cropland were considered, cropland remaining cropland and land converted to cropland. Within both of these categories, Tier 2 and Tier 3 methodologies were used. The Tier 2 approach is based on relatively simple equations used in IPCC (2003) methodology that have been modified to better represent nations or regions within nations. The Tier 3 approach (CENTURY model) uses a more complex ecosystem model to simulate carbon fluxes for cropped systems. Both tiers used land use and management data based primarily on the National Resources Inventory (NRI) (USDA 2000b). The NRI represents a robust statistical sampling of land use and management on all non-federal land in the United States, and greater

than 400,000 NRI survey points occurred in agricultural lands and were used in the inventory analysis. The methodology summarized below is described in detail in the U.S. GHG Inventory (EPA 2010).

3.6.2.1 CENTURY Model Simulations for Most Cropped Mineral Soils

CENTURY simulates carbon and nitrogen dynamics, soil water content and temperature, and other ecosystem variables (Parton et al. 1994). Key submodels include: plant growth, senescence of biomass, decomposition of dead plant material and soil organic matter, and mineralization of nitrogen. Model inputs are monthly maximum/minimum air temperature and precipitation, surface

Map 3-3
State-Level Carbon Dioxide Fluxes from Cropped Soils in 2008.



soil texture class, soil hydric condition, vegetation type, and land management information (e.g., cultivation timing and intensity, timing and amount of fertilizer and organic matter amendments). Soil organic matter is simulated to a depth of 20 cm, while water, temperature, and mineral nitrogen are simulated throughout the soil profile. Soil organic matter is divided into three pools based on decomposability: active (turns over in months to years), slow (turns over in decades), and passive (turns over in centuries). The model accounts for the effects of nutrient availability, water, and temperature on plant growth (CO₂ uptake) and the effects of these factors, as well as cultivation, on decomposition (CO₂ release). The ability of the model to integrate carbon gains and losses and simulate plant growth and soil carbon levels reliably has been demonstrated using data from many sites in the U.S. and around the world (Parton et al. 1994, Cerri et al. 2007, Ogle et al. 2007). The model has been shown to work in all the major biomes of the earth and can accurately reproduce the impacts of climate, soil texture, and land management on carbon fluxes (Parton et al. 1993, Kelly et al. 1997, Lugato 2007, Bricklemyer 2007). CENTURY has been parameterized to represent the major crops grown in the U.S. The major crops simulated by CENTURY for this analysis were corn, soybeans, small grains, hay, sorghum, millet, and cotton, which cover ~90% of U.S. cropland. Crops not simulated by CENTURY include; rice, sugarcane, tobacco, vegetables, orchards, and horticultural crops.

Three sets of simulations were performed: one to represent pre-settlement native vegetation, one to represent historical cropping, and one to represent modern cropping. This is important because

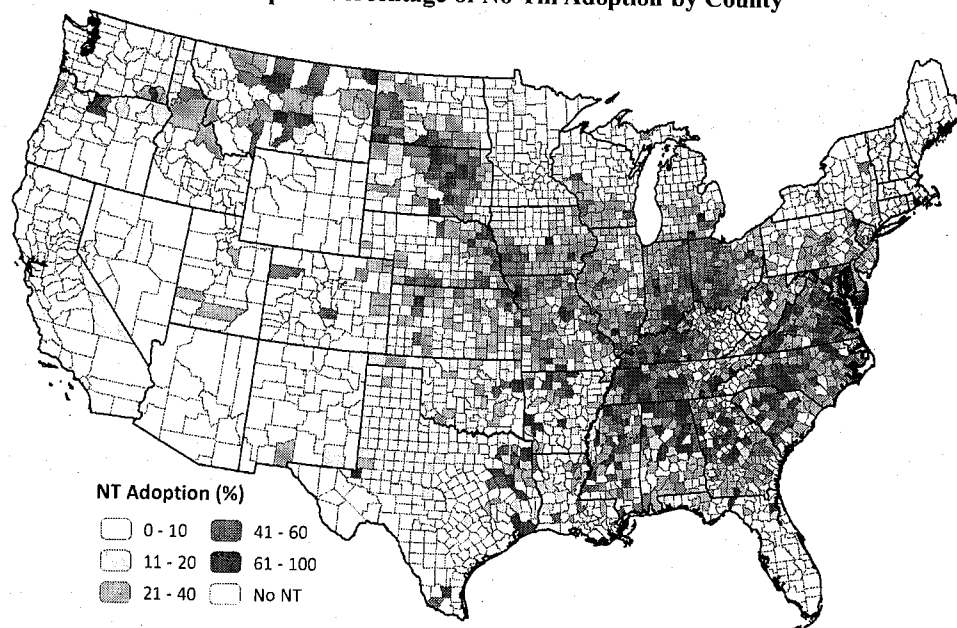
previous vegetation types and land management activities influence the capacity of present day soils to lose or sequester carbon. Native vegetation was represented at the MLRA (Major Land Resource Area, USDA NRCS 1981) level. MLRAs represent geographical units with relatively similar soils, climate, water resources, and land use. Data on historical cropping practices for different regions were obtained from various sources including historical accounts and from NASS. Beginning in 1979, the first year of the NRI survey, simulations of crops and management practices were based on NRI data. Additional data for tillage practices used (Maps 3-4, 3-5) were from the Conservation Technology Information Center (CTIC 1998). Crop-specific N fertilization rates were from the USDA Economic Research Service survey (ERS 1997) and other sources (e.g., NASS). Manure application rates were estimated from data compiled by the USDA Natural Resources Conservation Service (Edmonds et al. 2003). Monthly weather data required to run CENTURY were from the PRISM database. PRISM (Daly et al. 1994) is based on observed weather, and the resolution is 4x4 km grid cells. The data were area weighted to represent the agricultural land in each county in the U.S. Soil texture and drainage capacity (hydric vs. non-hydric) were derived from the NRI.

3.6.2.2 Tier 2 Approach for Remaining Cropped Mineral Soils, Organic Soils, and Liming

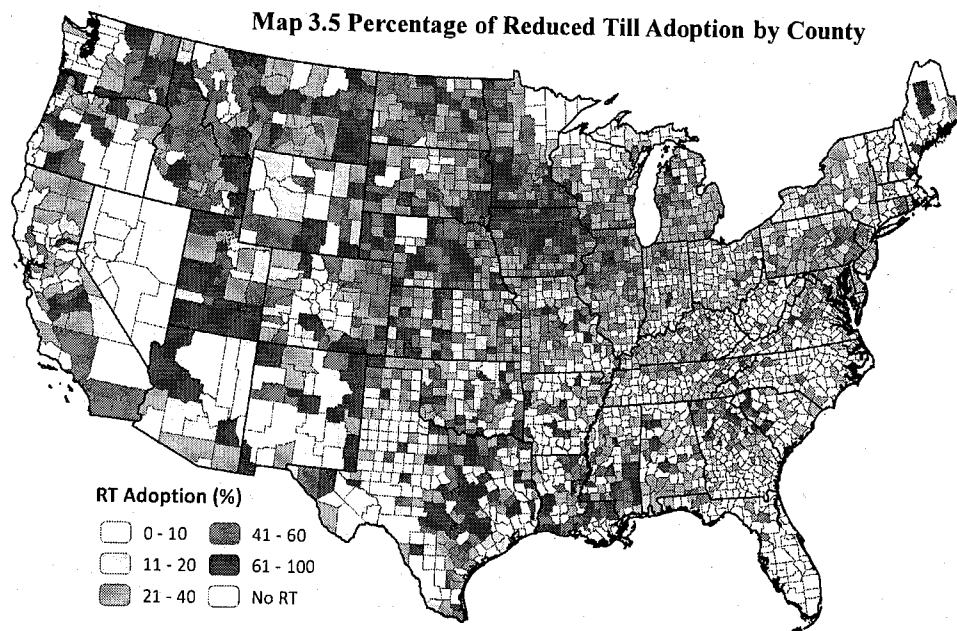
A Tier 2 approach was used to estimate soil carbon stock changes for crops not simulated by the CENTURY model, for non-agricultural lands that were converted to cropland, and for organic soils. Data on climate, soil type, and land use were used to classify land area and to apply appropriate stock change factors. U.S.-specific carbon stock change factors were derived from published literature to estimate the impact of management practices (e.g., changes in tillage or crop rotation) on soil carbon fluxes (Ogle et al. 2006b, 2003). Cultivated histosol areas are listed in Appendix Table B-5, carbon loss rates from organic soils under agricultural management in the United States are listed in Appendix Table B-6, state-level estimates of annual soil carbon stock changes by major land use and management type are listed in Appendix Table B-7, and state-level estimates of mineral soil carbon changes on cropland by major activity are listed in Appendix Table B-8.

Stock change factors and reference carbon stocks can vary for different climate regimes and soil types. The IPCC method defines eight climate types according to mean annual temperature, precipitation, and potential evapotranspiration. Six of these occur in the continental United States. The PRISM long-term monthly climate data set (Daly et al. 1998) was used to classify each of the 180 Major Land Resource Areas (MLRAs) in the United States into climate zones.

Map 3.4 Percentage of No-Till Adoption by County



Map 3.5 Percentage of Reduced Till Adoption by County



Reference soil carbon stocks were stratified by climate region and categorized into six major groupings, based on taxonomic orders that relate to soil development and physical characteristics that influence soil carbon contents. Estimates for carbon stocks under conventionally managed cropland (defined as the reference land use) were derived from the National Soil Survey Characterization Database (USDA NRCS 1997).

Based on the NRI, crop management systems were aggregated into 22 different categories. State-level estimates of mineral soil carbon changes on cropland by major activity are listed in Appendix Table B-9. Tillage practices are not included in the NRI. Thus, supplemental data were used from the Conservation Technology Information Center (CTIC 1998), which provides spatial information on tillage practices (Maps 3-4, 3-5). Data for wetland restoration under the Conservation Reserve Program (CRP) were obtained from Euliss and Gleason (2002). Manure N amendments over the inventory time period were based on application rates and areas amended with manure N from Edmonds et al. (2003).

Organic soils (i.e., peat, mucks) that have been drained and converted to cropland or pasture are subject to potentially high rates of carbon loss. Annual C losses were estimated using IPCC (2006, 1997) methodology, except that U.S.-specific carbon loss rates were used in the calculations instead of the default IPCC rates (Ogle et al. 2003).

Limestone and dolomite are often applied to acidic soils to raise the pH. However, CO₂ is emitted when these materials degrade. Emissions were estimated using a Tier 2 approach. Application rates were derived from estimates and industry sources (Minerals Yearbook, published by the U.S. Bureau of Mines through 1994 and by the U.S. Geological Survey from 1994 to present). The emission factors used, 0.059 ton CO₂-C/1 ton limestone and 0.064 ton CO₂-C/1 ton dolomite, are lower than the default IPCC emission factors because they account for a portion of limestone that may leach through soils and travel through waterways to the ocean (West & McBride 2005). The methodology summarized above is described in detail in Chapter 7 of the U.S. GHG Inventory (EPA 2010).

3.7 Uncertainty in Estimating Carbon Stock Changes in Agricultural Soils

Uncertainty was calculated separately for the Tier 3 and Tier 2 approaches used to estimate CO₂ fluxes. The methodologies summarized below are described in detail in Chapter 7 and Annex 3.13 of the U.S. GHG Inventory (EPA 2010).

3.7.1 Tier 3 Approach for Cropped Mineral Soils Simulated by CENTURY

As estimated by the CENTURY model, mineral soils on which major crops are grown sequestered 42 Tg CO₂ eq. in 2008 with a 95% confidence interval of +/- 64%. This uncertainty has three components: Monte Carlo approach to address uncertainties in CENTURY model inputs, an empirical approach to address structural uncertainty inherent in the model, and scaling uncertainty associated the NRI survey data. For model input uncertainty, probability distribution functions were developed for fertilizer rates, manure application, and tillage practices. A Monte Carlo analysis was conducted with 100 iterations in which input values were randomly drawn from the probability density functions to simulate the soil carbon stocks for each NRI cluster of points using CENTURY. An empirically based estimator was used to assess model structural error. This estimator was derived from a linear effects mixing model analysis of comparisons between modeled soil carbon stocks and measurements from 45 long-term experiments with over 800 treatments representing a variety of cropping, fertilizer, and tillage management practices (Ogle et al. 2006a). The model included variables that accounted for significant biases (alpha

level of 0.05) in CENTURY model estimates. For each carbon stock estimate from the Monte Carlo simulations, the structural uncertainty estimator was applied to adjust the model output for bias and prediction error. Uncertainty in land use statistics from the NRI were incorporated based on the sampling variance of the cluster of NRI points.

3.7.2 Tier 2 Approach for Remaining Cropped Mineral Soils, Organic Soils, and Liming

The CENTURY model has not been adequately tested with organic soils and soils used to grow non-major crop types (e.g., commodity crops, vineyards, fruit and nut trees) so an IPCC Tier 2 methodology was used for these soils. As estimated by Tier 2 methodology, mineral soils for non-major crops lost ~1 Tg CO₂ eq. in 2008 with a 95% confidence interval of -380% and +377% and organic soils emitted 30 Tg CO₂ eq. in 2008 with a 95% confidence interval of -39% and +31%. A Monte Carlo approach was used to simulate a range of values with 50,000 iterations by selecting values from probability distribution functions (Ogle et al. 2003). For mineral soils, probability distribution functions were derived from a synthesis of 91 published studies that addressed the impact of land management on soil carbon stock changes. For organic soils, probability distribution functions for emission factors were derived from a synthesis of 10 studies and combined with uncertainties in the NRI land use data for organic soils.

As estimated by Tier 2 methodology, liming of soils led to emissions of ~4.0 Tg CO₂ eq. in 2008 with a 95% confidence interval of -97% and +102%. Uncertainty in the emissions factors and uncertainty in data for agricultural use of limestone and dolomite were included in the analysis.

3.7.3 Combined Uncertainties

Uncertainties for the above components were combined using simple error propagation (IPCC 2006). That is, the combined uncertainty was calculated by taking the square root of the sum of the squares of the standard deviations of the components. The combined 95% confidence interval for CO₂ storage in cropped soils in 2008 ranged from -38 to 20 Tg CO₂ eq. around the estimate of -8 Tg CO₂ eq. (Table 3-1).

3.7.4 Changes Compared to the 2nd Edition of the USDA GHG Report

There were important changes in land classification data that effected C stock change estimates. Data from the USDA National Resources Inventory (NRI) are used to classify land use and management practices. In previous inventories, NRI data were collected in 5-year increments, and the last available year was 1997. Availability of new annual data extended the time series of activity data beyond 1997 to 2003. Also, each NRI point was simulated separately instead of simulating clusters of points that had common cropping rotation histories, and more exact cropping histories were simulated instead of generalized cropping rotations. Overall, these changes resulted in an average annual decline in soil C sequestration in mineral soils of close to 20 Tg CO₂ eq. for the reporting period compared to the previous Inventory. Uncertainties are also higher because soil C stock changes were estimated for each year from new annual NRI data instead of averaging over 5-year periods.

In addition, annual C flux estimates for mineral soils between 1990 and 2008 were adjusted to account for additional C stock changes associated with sewage sludge amendments using a Tier 2 method provided in IPCC (2003, 2006), which utilizes U.S.-specific C loss rates (Ogle et al. 2003) rather than default IPCC rates. Estimates of the amounts of sewage sludge N applied to agricultural land were derived from national data on sewage sludge generation, disposition, and nitrogen content. Total sewage sludge generation data for 1988, 1996, and 1998, in dry mass units, were obtained from an EPA report (EPA 1999), and estimates for 2004 were obtained from an independent national biosolids survey (NEBRA 2007). These values were linearly interpolated to estimate values for the intervening years. The stock change rate is based on country-specific factors and the IPCC default method.

3.8 Mitigation of CO₂ Emissions

Currently, cropped soils in the U.S. are estimated to be storing carbon at the gross rate of approximately 43 Tg CO₂ and a net rate of ~8 Tg CO₂ per year. However, the potential to store carbon is thought to be much higher (e.g., Sperow et al. (2003) estimated a potential of 220 – 255 Tg CO₂ per year). Strategies to increase soil C stocks include: reduction in tillage intensity, reduced cropping of organic soils, reduced summer fallow, planting non-growing season cover crops, increased land in CRP, and increased use of hay or pasture in crop rotations. Organic soils provide an opportunity to mitigate emissions because they make up less than 1% of total cropped land in the U.S., but are a source of 30 Tg CO₂ per year (Table 3-7). Summer fallow tends to decrease soil carbon because during a large part of the growing season plants are not present to provide carbon inputs but decomposition of soil carbon by microbes continues. Cropped land converted to CRP stores carbon because the land is not cultivated and trees or grasses are planted to provide carbon inputs. Including hay or pasture in rotations also increases carbon inputs, and carbon losses are lower because the land is not tilled during the hay or pasture phase of the rotation. We do not quantitatively estimate mitigation potential for this report because no recent nationwide analyses have been conducted.

Recent data suggest that a large portion of the cropped land in the U.S. is currently under reduced or no till cultivation (Maps 3-4, 3-5), thus the potential for further soil carbon gains by reducing tillage intensity may be limited. However, reduced tillage intensity does imply reduced on-farm energy consumption and lower CO₂ emissions. Similarly, the potential to convert cropland to idle CRP land is limited because the demand for biofuel feedstocks has incentivized keeping lands in production. Currently, about one-third of the corn crop is used for ethanol production, and the amount of cropland dedicated to biofuel feedstock production is expected to continue to increase as the nation moves towards the goal outlined in the Energy Independence and Security Act of 2007 to increase domestic ethanol production from the current level of ~11 billion to 36 billion gallons by 2022. A large portion of future biofuel feedstocks are expected to be supplied by perennial crops which can increase soil C stocks, but no national analyses to quantify this potential have yet been published.

Chapter 4: Carbon Stocks & Stock Changes in U.S. Forests

4.1 Summary

Forest ecosystems, urban trees, and forest products represent significant carbon sinks in the United States, offsetting approximately 12.7% of total U.S. greenhouse gas emissions. The net amount of carbon stored—that is, annual incremental change—by forests during 2008 in the United States is an estimated 704 and 88 Tg CO₂ eq. for forest ecosystems and harvested wood products (HWP), respectively. Net forest system (ecosystems plus HWP) total sequestration in 2008 was estimated to be 792 Tg CO₂ eq., with a 95% confidence interval of 935 to 651 Tg CO₂ eq. (Table 4-1). Compared to 1990, CO₂ sequestered by forest systems in 2008 was about 8% greater (Table 4-2). Although the net effect was zero, an additional 194 Tg CO₂ eq. was sequestered by trees, but harvested and burned to produce energy. Urban trees also sequestered carbon, about 94 Tg CO₂ eq. in 2008. Current total carbon stocks in forest ecosystems of the conterminous United States are

Table 4-1 Forest Carbon Stock Change Estimates and Uncertainty Intervals for 2008

Source	Estimate	95% Confidence Interval
	Tg CO ₂ eq.	
Forest	(704)	(846) to (567)
Harvested Wood	(88)	(110) to (67)
Total	(792)	(935) to (651)

Note: Parentheses indicate net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent.

Table 4-2 Carbon Stocks and Annual Change for Forest and Wood Pools and Forest Area, 1990, 1995, 2000, 2005-2008¹

	1990	1995	2000	2005	2006	2007	2008
Annual Change							
	Tg CO ₂ eq. yr ⁻¹						
Forest	(598)	(574)	(355)	(701)	(704)	(704)	(704)
Aboveground Biomass	(378)	(398)	(309)	(397)	(397)	(397)	(397)
Belowground Biomass	(74)	(79)	(62)	(79)	(79)	(79)	(79)
Dead Wood	(29)	(31)	(16)	(23)	(26)	(26)	(26)
Litter	(47)	(28)	3	(56)	(56)	(56)	(56)
Soil Organic Carbon ²	(70)	(37)	29	(146)	(146)	(146)	(146)
Harvested Wood	(132)	(118)	(113)	(105)	(109)	(103)	(88)
Wood Products	(65)	(55)	(47)	(45)	(45)	(39)	(24)
Landfilled Wood	(67)	(63)	(66)	(60)	(63)	(64)	(64)
Total	(730)	(693)	(468)	(807)	(812)	(807)	(792)
Carbon Stock							
	Tg CO ₂ eq.						
Forest	155,981	158,884	161,235	164,126	164,827	165,531	166,235
Aboveground Biomass	55,098	57,016	58,775	60,606	61,003	61,400	61,797
Belowground Biomass	10,948	11,328	11,677	12,041	12,120	12,199	12,278
Dead Wood	10,814	10,964	11,093	11,193	11,216	11,242	11,269
Litter	17,436	17,644	17,715	17,892	17,948	18,004	18,060
Soil Organic Carbon	61,685	61,932	61,974	62,394	62,539	62,685	62,831
Harvested Wood	6,817	7,440	8,021	8,525	8,631	8,739	8,842
Wood Products	4,514	4,807	5,069	5,264	5,309	5,354	5,393
Landfilled Wood	2,303	2,633	2,952	3,262	3,322	3,385	3,449
Total	162,798	166,323	169,256	172,651	173,458	174,270	175,077
Forest Area							
	1,000 ha						
Forest Area	267,986	271,194	273,767	276,796	277,536	278,276	279,016

Note: Parentheses indicate net sequestration. Tg CO₂ eq. is teragrams carbon dioxide equivalent.

¹Based on interpolation and extrapolation after aggregating plot-level data to state totals according to Smith et al. (2010).

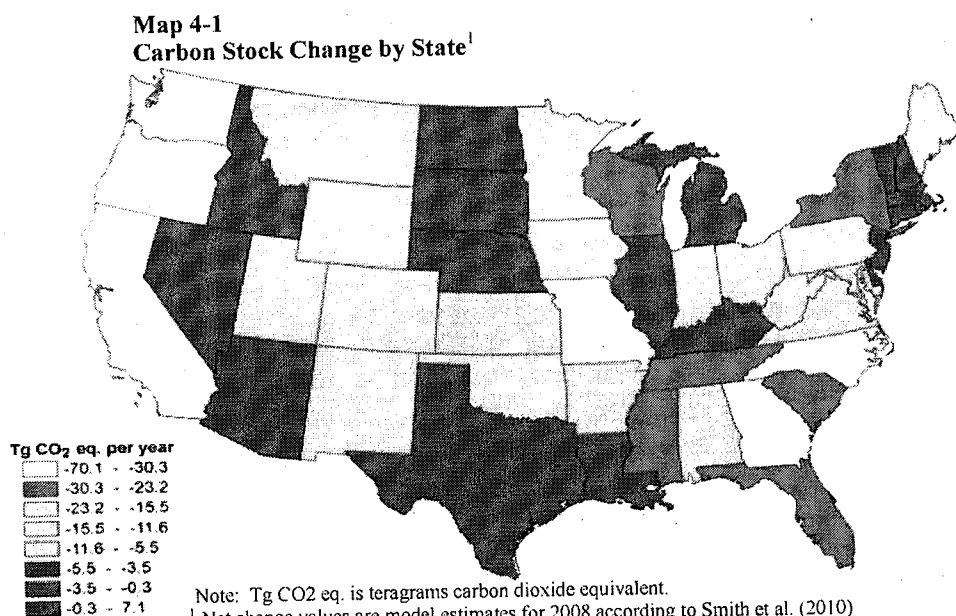
²Soil carbon does not include effects of land use history.

about 167 Pg CO₂ eq. (Table 4-2, Pg=1,000 Tg).

Periodic summary statistics on forestland in the conterminous United States indicate about a 3% increase in area between the compilation years 1987 to 2007, that is, about 9 million additional hectares (Smith et al. 2009). In addition to the net accumulation of carbon in harvested wood pools, sequestration is a reflection of net forest growth and increasing forest area over this period. Generally, the largest stocks and net annual changes are in biomass carbon.

Carbon sequestration rates for forests and harvested wood products are greatest in California, followed by Missouri, Georgia, Washington, Oregon, North Carolina, Wisconsin, and Mississippi (Map 4-1). Only six States are emitting more carbon than they are sequestering. The distribution of forestland in the conterminous United States is illustrated in Map 4-2; carbon stock and change summaries provided below are according to the 10- or 4-region sets specified in Map 4-3. Among the four regions, total carbon stocks and net annual change (sequestration) are greatest in the North. However, stock and change are greatest in the Pacific Coast region when expressed on a per-hectare basis (see Table C-1 for details of this summary). Hardwood forest type groups in the East formed the largest stock of carbon in biomass; this was about 27 Pg CO₂ eq. in comparison to about 15 Pg CO₂ eq. in softwood and mixed type groups in the East (Table 4-3). Softwood type groups in the West included about 25 Pg CO₂ eq. in biomass, whereas hardwood type groups accounted for about 4 Pg CO₂ eq.

Forestlands of the United States constitute 33% (304 million hectares) of total U.S. land area. These forestlands are surveyed by the USDA Forest Service, Forest Inventory and Analysis (FIA) program. A large proportion of these forests are managed for timber production. About 75% of forestland, 277 million hectares are classified as timberland, meaning they meet minimum levels of productivity and are available for timber harvest. Effects of management and land use change are implicitly part of the forest survey and are thus reflected in carbon stocks and stock changes. This chapter summarizes carbon stocks and stock changes on an average 273



million hectares located in the conterminous 48 States and coastal Alaska. Summaries of information included in this chapter represent updates of inventories and carbon estimations relative to the national

forest carbon budgets reported in the second edition of the USDA

Greenhouse Gas Inventory (Smith & Heath 2008).

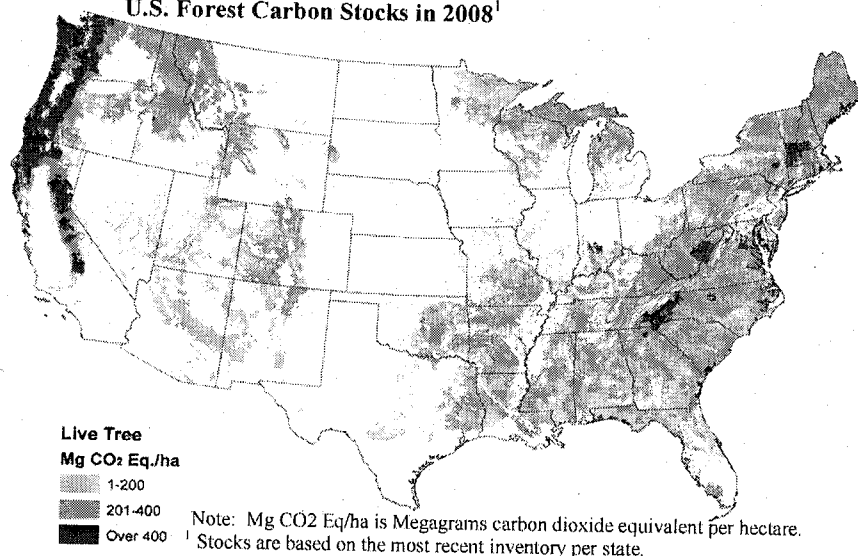
Estimates of stocks and net annual stock change for carbon on forestlands and in harvested wood products for the conterminous United States

presented here expand on the

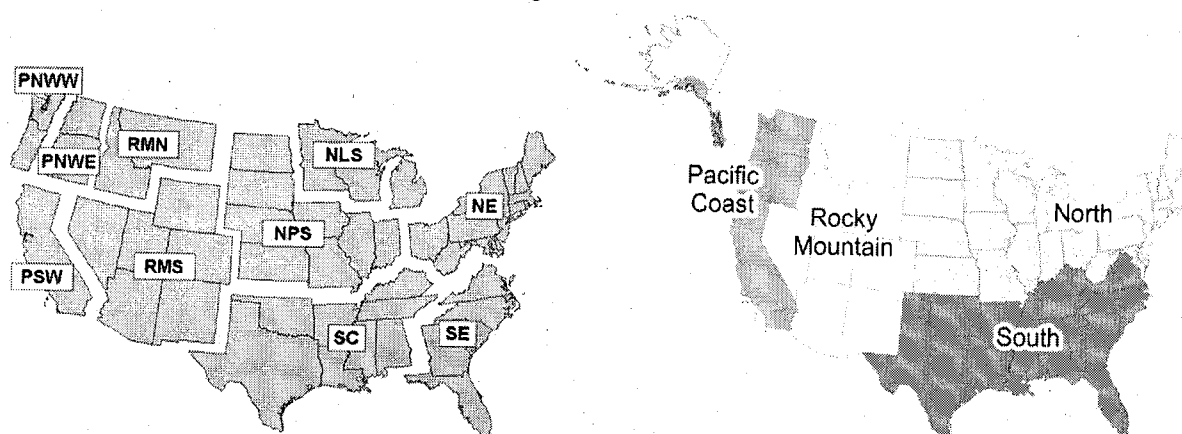
information reported for forestlands in Heath et al. (in press) and Chapter 7 of the most recent U.S. GHG Inventory (EPA 2010), and are consistent with reporting recommendations of the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance for Land Use, Land-Use Change, and Forestry (Penman et al. 2003). The summary tables provided in this chapter and in appendix C provide additional detail by summarizing data according to forest types, ownerships, or other classifications.

Although annual estimates are available beginning in 1990, we present estimates for a logical subset of years (Table 4.3). The post-2000 large increase in sequestration (Table 4-2) is due

Map 4-2
U.S. Forest Carbon Stocks in 2008¹



Map 4-3
Regions Used for Carbon Stock and Stock-Change Summaries¹



¹ Regions used for 10- or 4-region carbon summaries are: Pacific Northwest, West (PNWW); Pacific Northwest, East (PNWE); Pacific Southwest (PSW); Rocky Mountain, North (RMN); Rocky Mountain, South (RMS); Northern Prairie States (NPS); Northern Lake States (NLS); Northeast (NE); South Central (SC); and Southeast (SE). Note that regions are merged for some tables, these combinations include: PNWW, PNWE, PSW, and coastal Alaska as Pacific Coast; RMN and RMS as Rocky Mountain; NLS, NPS, and NE as North; and SC and SE as South. Pacific Coast and Rocky Mountain are collectively called West, and North and South are collectively referred to as East.